AN EDUCATIONAL ACHIEVEMENT PROFILE OF CHILDREN GRADES 1-6: INTERRELATIONSHIPS OF COGNITIVE, SOCIO-PERSONAL AND PSYCHOMOTOR FACTORS

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ABSTRACT

AN EDUCATIONAL ACHIEVEMENT PROFILE OF CHILDREN GRADES 1-6: INTERRELATIONSHIPS OF COGNITIVE, SOCIO-PERSONAL AND PSYCHOMOTOR FACTORS

by Jean M. Young

This study was concerned with determining whether there is evidence of interrelationships among cognitive, socio-personal and psychomotor factors in elementary school children. If so, there are implications for curriculum planning and development. Approximately 1,500 subjects, boys and girls, grades 1-6 in the Pontiac, Michigan, Public Schools were given a battery of academic, social, anthropometric and motor performance tests. Tests and analyses were conducted during a period of eighteen months.

Normative data was established from the tests by age groups and by sex for thirty-five variables, and interrelationships were computed by correlational and cluster analysis. Results of the study showed that relationships existed within specific areas (e.g., anthropometric) and between areas (e.g., academic and anthropometric). Some common interrelationships were noted in most age groups. Academic achievement measures were most closely related to other measures in the order of bone measurements, emotional stability and motor performance measures. Clusters were

identified within each area and also between eight combinations of areas (e. g., socio-motor) out of a possible eleven combinations. From these results it was determined that educational achievement profiles can be obtained on children grades 1-6 and that significant interrelationships exist among and between cognitive, socio-personal and psychomotor factors in children, grades 1-6.

On the basis of data presented, the writer recommends that:

--a research department within the Pontiac Schools be established;

--designs for flexible scheduling for teacher planning and consultations be determined;

--prescriptive teams for testing programs be formed;

--time for interdisciplinary planning be provided;

--new patterns for the role of specialists be discerned;

--educational achievement interpretive devices for pupils and parents be developed;

--in-service programs dealing with research be designed.

--tests now given in light of current findings on growth and development be re-evaluated and designed.

This study set forth evidence of existing interrelationships among cognitive, socio-personal and psychomotor factors, which have implications for curriculum planning and development.

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By

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CHAPTER I

INTRODUCTION

Many reputable educators accept as a truism that whatever a child does he does "all over." However, acknowledged interrelationships between mind and body frequently fail to be translated into teaching methods and into curriculum itself. This may be due partially to the fact that research is not sufficiently conclusive. Current literature and the establishment of clinics and research laboratories in centers of higher learning, however, illustrate an increasing interest by professional educators in research dealing with interrelationships.

Public school personnel in Pontiac, Michigan became interested in initiating some research, part of which was predicated on the existence of interrelationships among cognitive, socio-personal, and psychomotor factors in children of elementary school age. The writer, in consultation with staff members of the Human Energy Research Laboratory at Michigan State University,was encouraged to make a study of these factors.

An opportunity to develop a study which permitted this type experimentation was presented in the fall of 1963, when one elementary school in Pontiac had an unanticipated enrollment increase. This additional enrollment forced a change in the organizational pattern of the school to accommodate the larger number of students. The principal proposed that the library and the multipurpose room be used as teaching stations. Instead of increasing the classroom teacher allotment to the school the physical education teacher and the librarian would be employed on a full-time basis. This meant more pupils per class, but additional help could be expected from the specialists. This situation set the stage for a research study known as Project "E," which was to determine comparative growth of pupil achievement in two organizational structures, namely, (1) the proposed plan for full-time specialists and larger classroom loads, and (2) the traditional pattern of itemerant specialists and normal classroom loads. One of the hypotheses of Project "E," namely, that interrelationships exist among cognitive, socio-personal and psychomotor factors, constitutes the purpose of this study. Certain aspects of this study may be identified by the following questions.

1. What were some of the interrelationships which were presumed to exist among cognitive, socio-personal and psychomotor factors?

2. What were some of the correlations which appeared significant in working with children in grades 1-6?
3. How can batteries of tests, such as those employed in this study, be used as educational achievement profiles?
4. Would changes in one area (cognitive, socio-personal or psychomotor) affect readiness or growth in another area?
5. What implications for curriculum improvement can be drawn from the evidence of interrelationships that was supported in this study?

Two schools, with like population but with traditional class loads and itinerant specialists, were selected as control schools. Batteries of tests were given to pupils in the three schools in the fall of 1963 and the spring of 1964. These tests included academic, social-emotional and physical growth and motor performance measurements.

Statement of the Problem

The primary purpose of this study was to determine if, from the battery of tests there was any evidence to show that interrelationships existed among cognitive, socio-personal and psychomotor factors in elementary school children. Evidence of this nature is sorely needed to guide future action in curriculum revision. It is possible that an extended educational achievement profile could be established for grades

1-6 to make possible diagnostic and clinical use of the cognitive, socio-personal and psychomotor measures in combination with the established academic achievement measures. Such a procedure would make available considerably more evidence upon which to base individual guidance and curricular offerings.

The following section explains terms used in the study.

Definition of Terms

Anthropometric measurements--data collected on bone and fat quantity.

Cognition--as referred to in this paper, "the interaction and the summation of component organic and functioning parts of the mind and brain."

Control school--a school matched according to school population, school staff, and school community socio-economic level.

Experimental school--a school where certain variables were introduced.

Grade equivalency--an interpretation of test scores, where applicable, in terms of grade level. Grade level scores were computed from raw scores according to publisher's directions.

Intelligence data--measurements in cognitive areas, including academic achievement and intelligence quotients.

Motor performance data--measurements of specific tests for specific components of fitness.

Personality data--measurements of social approachability and emotional stability.

Project "E"--the total study of the approximately fifteen hundred original subjects plus projected study on subjects as they are admitted to the experimental school, and projected study on subjects as they are admitted to junior high schools.

Psychomotor--the component parts of motor ability as they relate to mental and environmental conditions under which motor tasks are performed.

Retest--the battery of tests given the second time in the spring of 1964 to the subjects who had taken the battery of tests the first time in the fall of 1963.

Socio-economic occupation scale--the Warner, Meeker and Ellis "Scale for Rating Occupations" (39).

Test--the first battery of tests given in the fall of 1963 to total school populations in the experimental and control schools.

Limitations of the Study

1. Different teachers have different skills in teaching and in relating to children, which have an effect on learning processes and performances of children.

2. There is variance in administering the tests due to the difference in observers and recorders whose interests, abilities, and conscientiousness which could affect pupil performance.
3. There are variables related to size and arrangement of rooms, temperatures in buildings and in the outdoors, time of administering tests, and attitudes of testing personnel and pupils.
4. Limits exist in setting up indices for measurement, achievement and performance. Some problems include:
   a. Anthropometric measurements (there is no single anthropometric index);
   b. Composite scores on academic achievements (which in this instance were limited to linear sums);
   c. Physical performance measurements (there is no single performance index in existence).
5. Problems existed relating to the analysis of data, including methods of collection, test validity, data reliability and the method of correlational analysis.
6. There are acknowledged shortcomings in testing tools such as:
   a. No known valid measure exists of general physical ability;
   b. There are limits in specific physical ability measurements;

c. There was previous validation only in grades 4 through 6 of the social approachability and emotional stability test;

d. Socio-economic scales do not take into consideration all existing jobs;

e. Achievement tests and intelligence quotients have recognized limitations in measuring achievement and innate intelligence.

f. Exact calibrations of testing apparatus are difficult to obtain, particularly when different brands of instruments are used.

7. The elapse of time between data collection and interpretation was too long to sustain interest and use by teachers who did the testing.

Sub-Problems

1. Pre-testing for reliability and validity of the SA-S* Test was necessary for grades one through three. This test had been given previously only in grades four through six at the elementary level in other sections of the country.
2. The eight-inch step test was administered prior to the major testing program on non-test groups of first,

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*Social Approachability and Emotional Stability Test, by Smith (118).

second and third graders to determine the level of usefulness at those ages.

3. Preliminary tests for certain motor performance tasks were necessary because of the response and level of comprehension in different age groups.
4. Ages were recorded by birthdate, necessitating a table for years and months to match against standard height and weight charts.
5. Calibration in instruments, which were bought or borrowed from various sources, was necessary.
6. Interpretation from pounds to kilograms was made into the form of a table for easier reading becuase different hand dynamometers were used.
7. Purchasing and constructing test equipment was required.
8. Preparation of testing personnel and school personnel was a major assignment in this project.
9. Related problems were concerned with scheduling, transporting and budgeting.
10. A small class of perceptually handicapped children was tested along with the three schools, so arrangements were made for including this class.
11. Preparation of the test manual necessitated preliminary testing on children and teachers (in non-test schools) to determine vocabulary.

12. Plans for longitudinal studies were included in the overall experimental design. Accompanying this design was the need to train new investigators. Physical education teachers, parents and student teachers were selected as investigators.

13. Designs for interpretation were considered throughout the project.

14. Arrangements were necessary for gathering, recording, processing and interpreting data. These plans included training secretarial personnel and developing budgetary proposals.

CHAPTER II

RELATED LITERATURE

The literature concerned with the human organism, its growth, development, and learning processes, has dealt quite broadly and in some depth with component interrelationships in certain areas--cognitive, socio-personal, and psychomotor. The major attention, however, seemed to be given to the linkage of two specific components in two areas (such as height and academic achievement), or with the relatedness of two or more components within a single area (such as work study and academic composite).

There was much written on correlation of components within defined areas, such as height and weight related to strength (all in the psychomotor area), or reading ability to mathematical ability (in the cognitive area), or social adjustment (in the socio-personal area). Two of the larger areas were sometimes described in terms of relationships (such as, sports participation and personality), but there was limited exploration in all three areas. There was conflicting literature on positive and negative significances of interrelationships of the areas--cognitive, socio-personal and psychomotor--and of their factors. There was also conflicting literature on the insignificance of interrelationships. It was evident that whatever experiments have been conducted, they were but a wedge into the complex problem of interrelationships. Although considerable amount of research on interrelationships has been completed at the college and secondary school levels, there has been comparatively little for elementary school children.

Literature indicated that approaches have been made through one area to enhance the development of another area. Intellectual learning may be accelerated because of physical activity, or physical performance may be greater because of personality adjustment, or anxiety may be an adverse influence on intellectual and physical performance. Certain curriculum designs have been initiated on the basis of appraisals of physical and mental and social growth (such as, team teaching, self-contained classrooms, ungraded primary, platoon systems, or core designs). Recognizing the limitations of depth studies in each area and of component interrelationships, the writer attempted to gather more from exact research as it related to the stated problem and less from philosophical writings.

The documents reviewed are presented in three sections, depending on the emphasis of the author or investigator. A table at the beginning of each section

presents a graphic résumé on the literature reviewed which dealt with interrelationships. Although included in Tables 2.1, 2.2 and 2.3, not all the works were summarized within the section since they did not deal specifically with elementary age children. Some works were reported only to show a particular emphasis, while others were reported to show evidence of interrelationships. These two reports are indicated by asterisks.

Cognition (see Table 2.1, p. 13)

The writer's concept of "cognition" evolved from several readings, but the greatest influence of the formation of the definition in Chapter I (p. 4) came from Frank H. George's Cognition (75). He wrote in terms of the unfiication of topics of learning, perception and thinking. Cognition is the interaction and the summation of component organic and functioning parts of the mind and brain.

Some cognition studies related primarily to generic influence of intellective functioning or to predictive indices. Others were concerned with effects of anthropometry, personality or environmental design on cognitive functioning and development. The literature studied seemed to establish a general thesis that cognitive development was related to anthropometry and to personality, but exact relationships were limited in definition. There was, for example, little data to support a hypothesis attempting

TABLE 2.1--Cognitive Area: Major Emphasis of Authors and Investigators.

Philosophic Interpre-tation	Developmental Stages of Maturation	Perception & Psychologic Factors	Perception & Motor Development	Generic Pro-cess & Educa-tion Theory	Predictive Factors
*George	*Piaget (S)	*4 Delacato		*Bruner	*Mitchell
Russell	*Oleron (S)	*5 Kinsedla		*Tanner	*Brown (S,P)
Prichard	*Debasse	*6 Cruickshank		*Heath	
	*L'Abate	*7 Smith			
	*Van Lennup	*8 Dephart			
		*9 Anderson (S,P)			
		Lichenstein	*Duffy 11 (P)		
			*Bills 12 (P)		
		*2 Zimmerman			
		*3 Brain			
		*1 Adrian			

(S) also found in Socio-Personal Factors Area
(P) also found in Psychomotricity Area

*Discussed in this section

to show a significant correlation between wiehgt at a given age and intellectual achievement. There seemed to be greater consensus that self-concept was influenced by body-build and that self-concept tends to influence achievement.

French investigators worked with the philosophical structuring processes of cognition, and provided a background for hypotheses dealing with cognitive factors related to the socio-personal and psychomotor factors. Piaget (34, 108) made provocative statements regarding logic and ethic and their development in the organism, even differentiating between Western and European thought in the evolution and development of moral judgments with regard to societal aims. He made careful note of various philosophies, historical and current, which supported or refuted his own theories of structuration. Piaget's thesis was that sensory-motor intelligence activates or practices the operations of assimilation and construction (of cognitive development), which is the functional equivalent of logic and relationships. He further explained that logic was not coexistent with intelligence, but rather consisted in an ensemble of rules of control of which intelligence made use for the purpose of eventual self-direction of the intellect. Piaget also said that sensory-motor intelligence was outer-checked (Westerners might here say "other-directed"), and that this intelligence was a search for coherence and organization, or the functional search for

organization. When the mind became aware of this search and its accompanying laws, it then translated into structure. This awareness was not a simple operation, but bound to an ensemble of psychological conditions.

Olerón (107) described this process of maturation as an internal condition, or a readiness of the organism for an activity. Development was characterized by the appearance of new capacities, whose emergence was dependent on maturity of the organism. He differentiated maturity from development, the latter including the former. Olerón likened maturation to the lengthening of the embryonic life. Both he and Debasse (63) hold that maturation was more than simply a system of relations, but that there was a myelinization of the organism which protected it from too-early and too-much environmental persuasion. Debasse explained that maturation was the rising of a person with nourishment at the right time; he added that it was not the simple concern for adaptation "so dear to American authors." Olerón and Debasse supported their theories by studies which showed regression from too-early training and which showed a catching-up from early restrictions. L'Abate's study (94) supported Piaget's theory of developmental stages in cognitive functioning.

VanLennup (124) reported observations on cognitive structuration and social structuration. He defined cognitive structuration, however, as intelligence and believed that maturity could be prefigured early in the structuration. Social structuration, loosely defined as "common sense," was developed, according to Van Lennup, through the person's conquest of autonomy by his rejection or acceptance of his environment, which is both formative and deformative. His experiments introduced three factors: social interest, sense of duty and imagination. Studies were made with five groups: the multilaterally gifted, the retarded, persons who showed giftedness early and reversed in later life, persons who showed little giftedness early but became successful, and persons with unparalleled giftedness (high intelligence, low emotional adjustment and the reverse). On the basis of his findings, recommendations were made for counselling (e.g., retarded persons were happier and more successful when they were led into structured, defined tasks).

Adrian (1) made a scholarly presentation on the physical background of perception, which included structure and function of the mind and brain. Zimmerman (128) wrote on the nature of spatial factors, an important aspect of perception to perceptual psychologists. Brain (5) spoke on the nature of experience, including the nervous system and physico-chemical changes, the nature of perception, fundamentals of movement and such aspects of perception as the visual after-image. He stated, "The perceptual world . . .is a construct of the percipient's brain" (p. 24).

Current studies in this country manifest a concern for depth understanding of the process of perception as a part of cognition. Perceptual psychologists have been conducting action research in areas of the structuring of function and sequential motor-sensory experiences. Older theories of psychology are being scrutinized and modified so that internal processes, as well as input and output are more clearly understood. Some of these studies have been made by Delacato (14), Kinsella (92), Cruickshank (12), Smith (37), Kephart (25) and Anderson (45). These studies include the background of perception and the searching out of relationships between motor growth, motor response, motor inhibition and cognitive performance and reading. From their several points of view these investigators indicated belief in cognitive structure and sequential development, and in perceptual arrest as a result of the inhibition of motor development. All these studies were authored in the 1960's.

Other authors and investigators approached cognitive development through anthropometry or through motricity. These investigators will be discussed more completely in the section, "Psychomotricity" (pp. 26-39). Duffy (65) and Bills (48) investigated muscular tension related to perceptive and cognitive processes. Brown (cited in Socio-Personal Factors and Psychomotor Areas and Mitchell considered predictive indices and the values of one component to another.

There has been increased emphasis on the role of cognition in the educative process. Perhaps the outstanding disciple of this relationship is Bruner (8), who explained the educative process in terms of generic learning. Tanner (122) studied education and physical growth, and set forth implications of the study of growth for educational theory and practice. Heath (83) related curriculum cognition and educational measurement. In his study he identified four types of cognitive preferences (memory of specific facts or terms, practical application, critical questioning of information and identification of fundamental principles) and developed a tool for the measurement of cognition. He used as experimental groups those in government-supported science programs. Cognitive preferences appeared to relate to Bruner's thesis of generic learning, which in turn appeared to relate to Piaget's theory of cognitive structuring.

<u>Socio-Personal Factors</u> (see Table 2.2, p. 19)

Frequently treated independently, these two areas, social and personality adjustment and development, are so interwoven in most of the literature that they will be considered as a combined area of literary research. A primary assumption in this section is that self-concept and the social environment are not only interrelated, but have bearing on cognitive development. In turn, anthropometric structure and motor performance have some bearing on the development of self-concept.

TABLE [illegible] Socio Personal Factors Area: Major Emphasis of Authors and Investigators.

Socio-personal

TABLE 2.2--Socio-Personal Factors Area: Major Emphasis of Authors and Invertigators.

Socio-personal Factors, Anthropometry, & Physical Growth	Body Image & Personality Development	Motor Ability & Socio-personal Factors	Motor Inhibition, Personality & Cognition	Behavior, Perception & Psyche	Environment, Personality & Behavior
Cabot (P)	*Fisher	Keoughs (P)	*Anderson (C,P)	Eriksen	*Cohen
*Murstein	Copple (P)	Beck	*Kephart (C,P)	Gordon	*Lindgren
*Piers	*Sanford	Franbony	Saranson	Borislow	*Warner
*Walker		*Brown (C,P)		*Smith	*Maddy
*Jones		*France		*Piaget (C)	Mead
		Murphy		*Maddy	
		*Reigart		*Lichenstein (C)	
		*Perié		Fraisse	
				Oleron (C)	
				*Gaier	

(C) also found in Cognitive Area
(P) also found in Psychomotricity Area

* Discusses in this section

Some studies showing a relationship between anthropometry, physical growth and socio-personal development were made by Cabot (9) Murstein (105), Piers (111), Walker (125) and Jones (89). Cabot's study was reviewed in the section, "Psychomotricity." Murstein used four variables in knowledge tests on 192 subjects to determine the most accurate predictor of motor ability. He found that the Wechsler-Bellevue Digit Symbol Subtest was the best predictor of fine motor skills. Piers and Harns attempted to develop a self-concept scale for a wide age range and to determine correlates of self-concept. A pool of items was taken from Jersild's collections of student observations on themselves. Tests at various levels showed that third and tenth graders were similar in mean total score, but both were significantly different from sixth graders. Variability showed a decrease with age. There was a relationship between self-concept and I.Q. and achievement, which was greatest at the sixth-grade level. Walker, at the Gessel Institute of Child Development, tested 147 nursery school children. He gave them physique ratings and asked for parent and teacher ratings (independently) on the behavior of the subjects. He found some relationships of these parent-teacher ratings between physique and behavior. Agreeable teacher-parent ratings indicated that boy and girl mesomorphs tended to be aggressive, highly energetic and cheerful, whereas boy and girl endomorphs

and ectomorphs tended to be unagressive, low in energy and not cheerful. There were some ratings which were contradictory, and also ways other than listed above, of physique grouping (such as mesomorph-endomorph and mesomorph-ectomorph). Jones discovered a pile-up effect of associated biological factors. For example, a child low in physical strength showed a variety of accompanying handicaps.

Body image and personality development studies were reported by Fisher (67), Copple (133, cited in Psychomotricity area, p. 25), and Sanford (113). Fisher and Cleveland employed the Rorschach Test to a wide application of reported testing, analyzing results with reference to body image. Partial correlations were found. A voluminous, comprehensive study was made by Sanford and others on relationships among physiques, personality, and scholarship. Anthropometric measurements were taken, clinical physiological studies were made, age was recorded and intelligence tests were given. Relationships were found, such as conceptual thinking and large body build; memory and general diet and other factors; comprehension, coordination and parasympathetic response; and mental age and parasympathetic response related to a short, wide build. Case studies were presented which supported the findings.

The bearing of motor ability on socio-personal maturation was studied by Keough (91), Beck (131), Frabony (134), Brown (51), France (135), Murphy (31), Reigart (137), and Périé (109).

A significant contribution by Brown was the feasibility of a developmental index which would be helpful to classroom teachers in identifying developmental factors, and in predicting academic achievement and social adjustment. Personal data, grid plotting, motor performance tests, social approachability and stability, intelligence tests and achievement tests were administered. Variables were intercorrelated separately for each sex.

France conducted a study using a random sample of 503 subjects from 3,600 to determine the effect of physical education on personality traits. No significant correlation was found.

Reigart's study, done at Western Reserve, Cleveland, determined relationships between physical growth and personality adjustment. She found that the poorly adjusted were below average in growth. Maladjustment was significant when grouped according to physique and the Roschach Test. She also found that obese persons were more compulsive, less controlled, poorly adjusted, emotionally unstable, immature, had less capacity for inner living and tended to be constricted.

Périé reported on a study sponsored by the French Office of High Commission for Youth and Sports, whose study objective was to determine psychosomatic unity. Investigators began with one variable, the introduction of physical and sports activity into school programs. The experimental design sought, by clinical examination and other tests, the incidences of variations of that factor on the general path of development of subjects (in psychosomatic unity). One hundred and thirty-eight observations were made on experimental and control groups. Groups were divided by ages thirteen to fifteen, and sixteen to eighteen. Results showed that the experimental groups had shorter reaction times and that their performances were more regular and stable. Experimental groups were found to reach the characteristics of maturity more rapidly, while control groups retained the reactive anarchy of motor behavior. Psychological examinations showed experimental groups to have more effective dynamism and a greater wealth of interests, coupled with a greater desire to learn. In summing up the ledger, Périé reported that the experimental group had better functional return, better psychomotor performance, better affective (emotional) and intellectual availability and that general maturation was accelerated through physical education and sports.

A research committee of the international council of physical education and sports reported studies dealing

with physical activity and social matuartion, which showed a correlation between the two areas. Dr. Périé's study was among several studies reported.

Motor inhibition appeared to have adverse effects on the development of personality and cognition. Studies departing from this hypothesis include those by Anderson (45), Kepart (25), and Sarason (114). Anderson hypothesized that the capacity for motor inhibition was correlated with a level of cognitive performance and that such correlation could be explained, particularly in terms of child-rearing practices and socio-economic status. This hypothesis was supported when tests of motor inhibition, cognition, socio-economic status, psychological control and dogmatism were administered to a sample of eighth grade students. Kephart's clinical work at Purdue tends to bear out this hypothesis through case study work. Children who were given additional motor work patterns tended to develop keener perceptual qualities. His work was primarily in the field of perceptually handicapped children.

Interrelatedness between behavior, perception and the psyche-learning process was investigated by Eriksen (16), Gordon (19), Borislow (50), Smith (37), Piaget (previsouly cited pp. 14, 15), Gardner (73), Maddy (98), Lichenstein (previously cited p. 14), Fraisse (70), Oléron (previously cited p. 15), and Gaier (71).

Smith and Dechant, in Psychology in Teaching Reading, (37), explored in depth the bio-physiological process of perception, and drew some conclusions regarding concept formation: (1) the greater the number of concepts the reader has fixed through words, the better tends to be his reading comprehension; (2) the more generic the reader's reaction to printed words, the more effective tends to be his communication; and (3) superior and poor readers are differentiated in abstracting and categorizing abilities. (This seemed to parallel Bruner's thesis on generic learning.)

Gardner andothers found correlates with intelligence components and a mutual interrelationship between intellectual ability and cognitive controls. Maddy, in comparing children's personality traits, attitudes and intelligence with parental occupation found that intelligence increased with a higher occupational level of their fathers. Personality tests were given to children selected on the basis of their fathers' occupations. There were reliable differences in intelligence and personality traits with differing occupational groups, and differences were found between sixth grade boys and girls. She found that children from professional families were 16.1 in I.Q. above children of semi-skilled, and that the latter were a group with more observable stress.

Gaier in his study selected presonality variables to relate to the learning process. He found that anxiety and rigidity characterized individuals less capable of improvising a new problem situation. He also found that personality variables appear to be involved as influences in cognitive operations. There were implications for measuring personality through cognitive-ability tasks. Gaier's tests were made on eleven subjects at the university level.

Literature indicated that environment or social structure affected personality and behavior. Studies showing this influence were made by Cohen (10), Lingdren (97), Warner (39), Maddy (previously cited p. 25), and Mead (27). Cohen's casebook on particular groups viewed in the social structure illustrated extreme effects of environment and particular social organization upon personality. Lingren made one of many such studies relating to ethnic or racial pocket groupings. Warner, Meeker and Ellis developed a scale frequently used by investigators for socio-economic classifications.

<u>Psychomotricity</u> (see Table 2.3, p. 27)

According to many researchers in the field of physical education, motor ability components include strenght, agility, speed, flexibility and coordination. As these components relate to mental and environmental conditions under which they are performed, they become known as "psychomotor." Cratty (11) reviewed components

TABLE 2.3--Psychomotor Area: Major Emphasis of Authors and Investigators.

Psychomotor Components	Congition & Socio-personal Psychomotor	Anthropometry & Motor Performance	Anthropometry, Motor Ability & Academic Achievement	Anthropometry, Motor Ability & Socio-personal	Brain Injured & Retarded (Academic or Physical)
*Cratty	*Copple (S)	*Cavel	Hinrichs	*Whittle	Bills (C)
*Jenkins	*Pierson	*Olson	*Sanford	Hebart	*Duffy (C)
*Carpenter	*Brown (C,S)	*Tyler	Bayley	*Jones	Anderson (S,P)
*Cunningham	*Sloan	*Montagu	*Klausmeier	Keough (S)	*Cruickshank (C)
*Brožek	*Ismail	Birren	Ray	Beck	*Kephart (C,S)
*Bachman	*Cratty	Brožek	Stuart	Frabony	*Delacato (C)
*Cowen	*Millard	*Harrison	*Bauer	France	*Godfrey
*Cumbee		*Seils	*Sprague	*Cowell	*Buchner
*Espenschade		*Riley	*Thompson	*Cabot (S)	*Cavel
*Frankard			*Ismail	*VanLennup	
Goodenough			*Mayer	Walker	
Johnson			*Gleason	Reigart	
Latchaw			*Tanner	*Fisher	
Scott			*Clarke		
*Start					
*Strong					
*Wegner					
*Tobias					

(C) also found in Cognitive Area
(S) also found in Socio-Personal Factors Area

* Discussed in this section

and matrices developed by McCloy, Jones, Fleishman, Guilford and Hollingworth (pp. 42-48). Psychomotor components were researched by Jenkins (23), Carpenter (54), Cunningham (62), Brozek (52), Bachman (46), Cowen (58), Cumbee (61), Espenschade (66), Frankard (69), Goodenough (78, 79), Johnson (88), Latchaw (95), Scott (115), Start (119), Strong (120), and Wegner (141).

Studies made on young children by Jenkins, who used a battery of motor performance tests, showed closer relationships on tests and retests on sex rather than I.Q. factors. Carpenter measured general motor capacity and general motor ability in the first three grades, using the Brace, Burpee and Sargent tests. Findings indicated that more intelligent children worked harder. Cunningham found a relationship between motor tests and body build in infants and very young children (up to nearly two years of age).

Brožek and Taylor concluded that motor performance was more susceptible to deterioration under stress than were sensory and intellectual functions. Bachman tested motor learning and performance in relation to age and sex in measures of balance coordination. He found results related to initial skill and to amount of learning. Cowen and Pratt used the hurdle jump as a developmental diagnostic test of motor coordination for children ages three to twelve. They found that weight was not a factor in determining the height of the jump, and that height was negligible compared with age in determining the height of the jump. Cumbee, Meyer and Peterson developed a factorial analysis of motor coordination variables for third and fourth grade girls.

Espenschade studied motor performance in adolescence. She found interrelationships with motor performance as a function of age and sex. Boys all correlated significantly except for the target throw, but there was small correlation for girls. She used motor performance as a function of physical maturity, finding a relationship to anatomical development with a positive significance for boys. Correlation between motor performance of girls and all measures of physical growth and maturity were low and in most cases not statistically significant. Motor performance for boys was positively and significantly related to all measures of maturity.

Grouping could be based on organic and motor aptitude factors, according to Frankard and Walckiers. They presented a case for individualized teaching in physical education.

Start, in attempting to measure mental practice on efficacy of movement found no significant gain either related to initial score or later transfer. Strong reported on the part of motivation in motor performance tests. Wegner made a factorial analysis on selected motor ability test on 114 male college students. His analysis

was made for the purpose of discovering primary components and relationships, for developing a battery of tests, and for determining validity.

A number of studies have taken into account the three major areas (cognition, socio-personal factors, and psychomotricity) to illustrate interrelationships and interdependences. Copple (133) tested over 100 fifth grade boys to determine correlations between reading skills, motor development and physical fitness, recognized athletic ability and the individual's self-concept in relation to physical development. He found a significant correlation between the left hand grip and reading achievement, and partial correlations between reading achievement and peer and teacher ratings of athletic achievement. Peer and teacher ratings of athletic achievement were in reverse of the predicted direction.

Pieron, Henri, Chocholle and Leplat (110), conducted statistical and clinical studies and found sequential stimulative sensory tendencies to be in accord with total ensemble of psycho-physiological and neuro-physiological facts. Brown (51) studied relationships between selected intelligence, physical growth, physical performance and social-emotional variables for the purpose of developing an index to predict academic achievement for fourth through sixth graders. Sloan (117) found close relationships between intelligence, motor behavior and social

maturity using the Lincoln-Oseretsky motor development scale. Ismail and others (20) used motor aptitude tests to predict academic achievement. The following conclusions were drawn from extensive testing: (1) there was no sex difference in pattern pertaining to predictions; (2) I. Q. scores were predicted more accurately than were academic achievement scores; (3) high or low motor achievers were more readily predictive. Cratty (11, previously cited pp. 26-28) made extensive reviews of movement behavior and motor patterns with regard to other areas of behavior and achievement.

Millard (28) interrelated growth factors as an approach to studying the child as a whole. He investigated various aspects of growth (physical, motor, intellectual and personal-social). Each of the areas of growth, in turn, was broken down more completely. The significance of this book was in its usefulness to teachers in teaching the child as an interrelated being.

Anthropometry was studied, along with growth and development factors and with physiological factors as bases for predicting or relating to intellect, academic achievement, self-concept and personality-behavioral projection. Thooris (Cavel, 56), the celebrated French morphologist, determined a strong correspondence between aptitude and body shape. There were differences of opinion between morpholigists regarding morphological stability as

opposed to retractible and debiliatory morphology. There seemed to be strong indication, however, that there was some early predictive value which lasted throughout the life span of the organism, barring extreme effects upon the organism (such as malnutrition).

Olson (32) is known for his growth and development works, and especially for his tool to determine organismic age. Tyler (according to Ismail, 21) did supportive work on organismic age along with growth concepts.

Montagu's handbook of anthropometry (29) was useful in conducting tests, as it detailed exact measurements, stances and other pertinent information.

Harrison (82) reviewed neuromuscular bases for motor learning. Seils (116) found relationships between skeletal maturity and motor performance in testing primary grade children. Riley (138) tested two hundred eighty-seven girls in grades one through nine to discern relationships between anthropometric measurements and physical performance. She found the grip strength the only relative factor to performance at every age. Other fairly consistent relationships were jumping ability to ponderal index, endurance to waist/neck index and speed to waist girth. Agility and throwing were least related to anthropometric measurements. The greatest variability in anthropometric measurements was found among children nine and ten years of age.

Sanford (113) and others tested according to several variables--intellectual ability, age, physiological and physical measurements. Intellectual ability comprised tests of mental age, comprehension, memory and conceptual thinking. These were correlated separately to data on body build. A close relationship was found to exist within anthropometric measurements because of their interdependence. Specific correlates were determined, as mental age and parasympathetic response and short, wide build.

Studies were made to show relationships between motor ability and academic achievement. Investigators include Bayley (47), Klausmeier (93), Ray (112), Stuart (121), Bauer (130), Sprague (139), Thompson (140), Ismail (21) and Mayer (100).

Klausmeier, Lehman and Beeman studied relationships among physical, mental and academic achievement measures in children of low, average and high intelligence. Their hypothesis, that a low level of physical achievement within a child accompanies low achievement in arithmetic and reading, was upheld. This prediction and test results proved to be true for boys but not for girls.

Bauer found in a study of sixth grade children that the level of parental education was an important factor in the child's mental and motor achievement, but that capacities and achievements in each field were not significantly correlated. Sprague, in testing eight-year-old

boys in motor skill measures concluded that generally, interrelationships were significant at the five percent level, and that intelligence and socio-economic status had no apparent relationship to performance of gross motor skills, but were positively related to motor coordination.

Statistically significant positive relationships were found by Thompson between specific motor ability tests and specific mental achievement tests (as balance beam walking and arithmetic achievement). She also found some negative correlations between specific tests. Thompson found little evidence of a general relationship between motor performance and mental achievement. Some studies showed positive correlations while others showed negative or no significant correlations with specific tests in each of the two areas--motor ability and academic achievement.

Ismail, Kephart and Cowell reported on predictive ability of motor aptitude tests for academic achievement. They also list studies by Gates and Thurstone. Gates studied interrelationships of physical and mental ability and maturity, while Thurstone's study compared mentally retarded children with normal children on eight items of gross motor achievement to find some significant differences. Mayer found parallelisms in French students who were both champion athletes and students of academic merit.

Relationships were found between physique and intellect. Investigators in this area included Gleason (76), Tanner (122) and Clarke (132). Gleason's and Klausmeier's hypothesis presented the existence of a positive correlation between physical growth and academic achievement and was confirmed for third grade boys and girls and fifth grade girls. Tanner showed implications of the study of growth for educational theory and practice.

Clarke and Jarmon tested two hundred seventeen boys on strength index at nine effective differentiations of academic achievement. High and low strength groups were paired or equaled by I.Q. Findings showed a consistent and significant tendency for high strength groups to have higher means on standard achievement tests and on grade point average.

Whittle compared twelve-year-old boys' skeletal measurements, age, weight, height and personality development. He found a significant difference between the means of boys in good or poor physical education programs (determined by a score card). Those in good physical education programs had higher means in Rogers' strength and fitness indices and in other tests of motor educability and physical fitness.

Motor ability and socio-personal correlates were studied by such investigators as Hebart (84), Jones (89), Keough (91), Beck (131), Frabony (134), France (135) and

Cowell (57). Jones, in sequential growth studies took physical measurements to illustrate the effects of personality in activity pursuit. He concluded that there was a regularity in emergence of behavior and a general overlapping of functions at earlier stages. He found motor ability to be dependent on maturation and the nature of a skill.

Cowell and Ismail tested eighty-three boys ten to twelve years of age on given motor fitness and athletic aptitude tests, seeking relationships of athletic aptitude to leadership. All relationships were found to be positive, moderate and significant at the one percent level of confidence.

Reports from the international congress of physical education and sports, organized in Paris, included works done by Périé and Chambart on physical activity and social maturation in adolescence, and also those by Cahilley-Bett, Encausse and Plas on physical activity on the development of school children.

Physique and personality relationship studies were made by Cabot (9), Van Lennup (124), Walker (125), Reigart (137) and Fisher (67). Cabot found that height was related to social leadership, attitudes toward war, schizothymic* trends, influence on one's contemporaries,

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*A schizoid condition or temperament remaining within the bounds of normality.

competitiveness, self-control and intelligence. However, differences were not sufficiently significant to be regarded as certain. The male adolescent who was definitely taller that his peers tended to be more intelligent, competitive and more of a social leader, exerting his influence over others. The shorter male adolescent was found to be more self-controlled and schizothymic.

Studies made by Van Lennup at the University of Utrecht revealed relationships between maturation, personality and professional or scholastic success. Although his conclusions were cautious, the study contained recommendations for guidance and counseling in formative years. Walkers, at the Gessel Institute of Child Development, tested one hundred forty-seven nursery school children on physique ratings (body shape) and parent ratings of behavior. Results were reported under the section, "Socio-personal Factors" (p.18). Reigart's study was also reported in this section (p. 22). Fisher and Cleveland used the Rorschach Test to correlate results with body image. A wide application of testing was reported. Other studies dealt with muscular tension as it related to physical or mental performance, and also with motor inhibition and cognitive performance. Investigators included Bills (48), Duffy (65) and Anderson (45).

Duffy investigated muscular tension relative to the perceptive process, using various physical and physiological factors. Correlations were suggested with aspects of behavior, including muscular performances, number words use, and the degree of restlessness and inattention. Eigtheen nursery school children were his subjects. He found some relationship between tension and body build, between systolic blood pressure and pulse rate, and between tension and muscular performance. Anderson's study was mentioned in the section, "Cognition", p. 17.

Other therapeutic-type studies dealt with motor training for brain injured and for retarded children. Such reports have been made by Cruickshank (12), Kephart (25), Delacato (14), Godfrey (77) and Bucher (53). Cruickshank and Delacato are particularly noted for their contributions to the field of reading. Kepart's clinical work was primarily with brain-injured children, who seemed to respond to motor therapy in the form of motor pattern training. Much of his work was done directly with the parents of children attending the clinic. Godfrey reported on studies with perceptually handicapped children and the effect of motor training in developing perceptual take efficiency. Bucher's article dealt with psychomotor re-education.

Picq and Vayer (as reported by Cavel, 56) showed an improvement in children even with I. Q.'s below fifth when given psychomotor education. In their experiment they introduced variables of anxiety, lack of attention and exercise. The latter category included equilibrium, spatial

organization, time and rhythm, basic physical movements, relazation, sensory education and manual education. A study of psycho-physiological theory was the basis of education for retarded persons. They found relationships inspearable between the motor and the psychic areas.

While some researchers found a significant correlation between such factors as body build and conceptualization, it would appear that more investigators would claim such correlations with additional factors considered, including nutrition, environment and a host of others. It seemed to be consensus that interplay between cognition (including motivation), socio-personal adjustment and psychomotricity is so interwoven that it is extermely difficult to extract any two factors and claim a significant interrelationship. Tobias stated this idea, "For any child to function in an orderly and integrated manner, it is postulated that his internal environment as well as his external environment should be individually and collectively in a state of balance" (123, p. 967). The concept of child ecology--the relationship of the human organism to his environment--seems to be paramount in the consideration of studies of interrelationships.

The evidence, as reported, leads the reviewer to believe that additional studies of greater magnitude and with more accuracy in reporting are necessary before conclusions can be drawn regarding exact interrelationships in the areas and/or components of cognition, socio-personal behavior and psychomotricity.

CHAPTER III

SOURCES AND METHODS

The establishment of educational achievement profiles is contingent upon the selection of a reliable battery of tests designed to measure cognitive, socio-personal, and psychomotor factors. A discussion of the tests used in the study and the presentation of reliability data form the basis of this chapter. Preliminary and initial plans for the study, which were concerned with personnel training, test organization and test administration are also included. The section, "Sources of Data," includes tests and reliability tables. Manufacturers of test equipment and publishers of test materials are listed in the Appendix (Item 1) and in the Bibliography, respectively. The section, "Methods of Procedure," contains descriptions of initial plans for the study, pre-tests used, the training of test personnel and organization and administration of the testing program.

Sources of Data

1. Academic achievement tests.

1. a. Iowa Basic Skills Tests were given to grades three through six in the fall of 1963 and in

the spring of 1964. Classroom teachers administered these tests under the direction of the Director of Pupil Testing for the City Schools of Pontiac. Grade equivalency was recorded for component scores and composite scores: academic vocabulary, reading comprehension, total language, total work study, total arithmetic and academic composite.

Tables 3.1 and 3.2 were taken from page 73, and Tables 3.3 and 3.4 from page 74 in the _Iowa Basis Skills Test Manual_ (99). The tables on pages 42 and 43 are presented to show test reliability.

1. b. The Metropolitan Reading Test was given as test and retest to second graders. A composite score and its components (as listed) were recorded in grade equivalency: word knowledge, word discrimination, reading, spelling and arithmetic. Tests were administered by classroom teachers under the direction of the Director of Pupil Testing for the City School of Pontiac. Table 3.5 was taken from _Directions for Administering Metropolitan Achievement Tests: Primary II Battery for Grade 2_, p. 24 (64) (see p. 45).

1. c. The Metropolitan Reading Readiness Test was given as the test to first graders (Fall only). The

TABLE 3.1.--Iowa Basic Skills Test. Standard Deviations, Standard Errors of Measurement, and Reliability Coefficients for Grade 3.

Test	Standard Deviation		Standard Error of Measurement		Reliability Coefficient
	Raw Score Units	Grade Equivalent Units	Raw Score Units	Grade Equivalent Units	
Vocabulary	7.03	10.22	2.81	4.09	.84
Reading	10.10	9.81	3.03	2.94	.91
Spelling	6.32	11.41	2.21	3.99	.88
Capitalization	5.69	7.98	2.39	3.35	.82
Punctuation	4.53	6.50	2.22	3.19	.76
Usage	6.26	10.42	2.63	4.38	.82
Language Total	4.86	7.00	1.26	1.82	.93
Map Reading	4.26	8.81	2.34	4.85	.70
Graphs and Tables	3.89	11.21	1.98	5.72	.74
References	6.36	7.44	2.54	2.98	.84
Work-Study Total	4.28	7.07	1.37	2.26	.90
Arithmetic Concepts	5.99	8.93	2.34	3.48	.85
Problem Solving	4.70	6.66	2.16	3.06	.79
Arithmetic Total	5.00	7.14	1.65	2.36	.89
Composite	5.70	7.29	.97	1.24	.97

TABLE 3.2--Iowa Basic Skills Test. Standard Deviations, Standard Errors of Measurement, and Reliability Coefficients for Grade 4.

Vocabulary	8.93	11.47	3.30	4.24	.86
Reading	14.14	13.76	2.83	2.75	.96
Spelling	8.17	12.69	2.61	4.06	.90
Capitalization	6.95	10.41	2.71	4.06	.85
Punctuation	5.70	12.56	2.68	5.90	.78
Usage	6.70	14.81	2.68	5.92	.84
Language Total	5.75	10.74	1.27	2.36	.95
Map Reading	5.69	10.84	2.28	4.34	.84
Graphs and Tables	4.78	10.83	2.10	4.77	.81
References	7.56	9.10	2.72	3.28	.87
Work-Study Total	5.30	9.05	1.38	2.35	.93
Arithmetic Concepts	6.94	9.22	2.71	3.60	.85
Problem Solving	4.97	7.74	2.19	3.41	.81
Arithmetic Total	5.37	7.93	1.72	2.54	.90
Composite	7.20	9.61	1.01	1.35	.98

TABLE 3.3--Iowa Basic Skills Test. Standard Deviations, Standard Errors of Measurement, and Reliability Coefficients for Grade 5.

Test	Standard Deviation		Standard Error of Measurement		Reliability Coefficient
	Raw Score Units	Grade Equivalent Units	Raw Score Units	Grade Equivalent Units	
Vocabulary	9.35	13.73	2.62	3.84	.92
Reading	15.43	14.36	3.72	3.45	.94
Spelling	9.28	13.37	2.60	3.74	.92
Capitalization	7.09	14.96	2.98	6.28	.82
Punctuation	6.34	17.34	2.09	5.72	.89
Usage	6.34	19.34	2.54	7.74	.84
Language Total	6.19	14.04	1.38	3.09	.95
Map Reading	6.28	11.27	2.51	4.51	.84
Graphs and Tables	4.07	11.17	2.20	6.03	.71
References	9.85	10.26	2.96	3.08	.91
Work-Study Total	5.97	9.46	1.43	2.27	.94
Arithmetic Concepts	6.68	8.58	2.81	3.60	.82
Problem Solving	4.86	8.75	2.33	4.20	.77
Arithmetic Total	5.40	7.39	1.78	2.60	.89
Composite	7.73	10.65	1.08	1.49	.98

TABLE 3.4--Iowa Basic Skills Test. Standard Deviations, Standard Errors of Measurement, and Reliability Coefficients for Grade 6.

Vocabulary	10.32	15.94	2.89	4.46	.92
Reading	13.99	13.59	3.64	3.53	.93
Spelling	9.37	13.36	3.00	4.28	.90
Capitalization	7.05	16.09	2.82	6.44	.84
Punctuation	6.54	18.82	2.75	7.90	.82
Usage	6.11	20.41	2.44	8.16	.84
Language Total	6.30	14.88	1.39	3.27	.95
Map Reading	5.11	12.04	2.25	5.30	.81
Graphs and Tables	3.93	11.26	1.93	5.52	.76
References	10.48	11.16	3.14	3.35	.91
Work-Study Total	5.69	9.92	1.37	2.38	.94
Arithmetic Concepts	7.51	8.84	3.00	3.54	.84
Problem Solving	5.77	9.89	2.42	4.15	.82
Arithmetic Total	6.07	8.59	1.94	2.75	.90
Composite	7.71	11.19	1.08	1.57	.98

total readiness score was recorded in raw score as there was no determinant for grade equivale cy in the readiness test. Table 3.6 was taken from Metropolitan Readiness Tests: Form R, page 30 (102) (see p. 45)

All academic achievement tests were administered in the three schools during a given six-week period in the Fall and a given six-week period in the Spring.

The following tables show test reliability.

2. Intelligence test.

The Stanford-Binet Intelligence Test is administered only periodically in Pontiac. When intelligence quotients were not taken during the first year of Project "E" test, previous I.Q. records were taken from class folders. There was no retest.

3. Social approachability and emotional stability test.

The SA-S Junior Scale (Smith, 118) was used for testing social approachability and emotional stability in grades one through six. Brown (51) used the test in grades four through six, but the test was not tried in grades one through three. Pre-testing on non-related experimental subjects was done in Pontiac.

The test is comprised of eighty-four items which require marking "x", "yes," or "no." Items one through forty-six are geared to social approachability; items forty-seven through eighty-four are

TABLE 3.5--Metropolitan Achievement Tests: Primary II. Reliability Coefficients and Standard Errors of Measurement for Subtests.

Test	r_{11}* Range	r_{11}* Mdn.	S.E. Meas.** Range	S.E. Meas.** Mdn.
1. Word Knowledge	.86-.96	.93	1.5-2.6	2.2
2. Word Discrimination	.86-.92	.88	1.8-2.4	2.3
3. Reading	.94-.95	.94	2.3-2.9	2.8
4. Spelling	.92-.95	.93	1.8-2.3	1.9
5. Arithmetic:				
Part A Concepts and Problem Solving	.80-.87	.86	2.1-2.5	2.4
Part B Computation	.74-.88	.80	1.5-2.0	1.7
Total (Parts A & B)	.85-.92	.91	2.6-3.2	2.7

*Values reported are ranges and medians of four independent estimates of corrected split-half coefficients. Each estimate is based on a random sample (N = 100) of grade 3.1 pupils from a single school system, the four systems being chosen to typify high, low and average performance on the test.

**Standard error of measurement in terms of raw score.

TABLE 3.6--Reliability Coefficients and Related Data, Metropolitan Readiness Tests, Grade 1.

Test	Rel. Coeff.	1st Testing Mean	1st Testing Stan. Dev.	2nd Testing Mean	2nd Testing Stan. Dev.	Stan. Error Meas.
Word Meaning	.583	15.61	2.51	15.92	2.26	1.62
Sentences	.535	10.52	2.39	10.86	2.27	1.63
Information	.586	12.02	2.06	12.39	1.89	1.33
Matching	.773	13.19	4.23	14.19	3.75	2.02
Numbers	.839	13.50	4.78	14.38	4.85	1.92
Copying	.762	5.26	2.76	5.31	2.75	1.35
Tests 1-4	.828	51.07	8.83	53.20	8.13	3.66
Tests 1-6	.890	69.71	13.92	72.96	13.12	4.62

geared to emotional stability. There are periodic "lie" questions throughout the test. Quadrant scales are used for scoring. Illustration 3.1 is taken from p. 3 in the Manual for the SA-S Senior and Junior Scales (118), to show quadrant plotting. Table 3.7 shows reliability coefficients (from p. 16 in the Manual just cited) (see p. 47).

The "SA" (social approachabaility) part of the test is diagrammed on the horizontal plane of the quadrant. On this plane, "permeable" is defined as sensitivity to social environment. "Impermeable" is defined as conservative, fixed, asocial and conscientious. The "S" (emotional stability) part of the test is diagrammed on the vertical plane. On this plane, "stable" is defined as freedom from excessive anxiety, and "anxiety" is defined as a continuing state of tension, SA-S tests were administered by classroom teachers under the direction of the Project "E" Director. The Appendix contains SA-S Test Questions (Item 2a), SA-S Explanation Sheet (Item 2b), Master Grading Answer Sheet (Item 2c) and Pre-Test Information (Items 2d and 2e).

4. Anthropometric measurements

Testing tools were purchased and borrowed for anthropometric measurements. Investigators were

Illustration 3.1.--SA-S Senior and Junior Scales Quadrant Plotting.

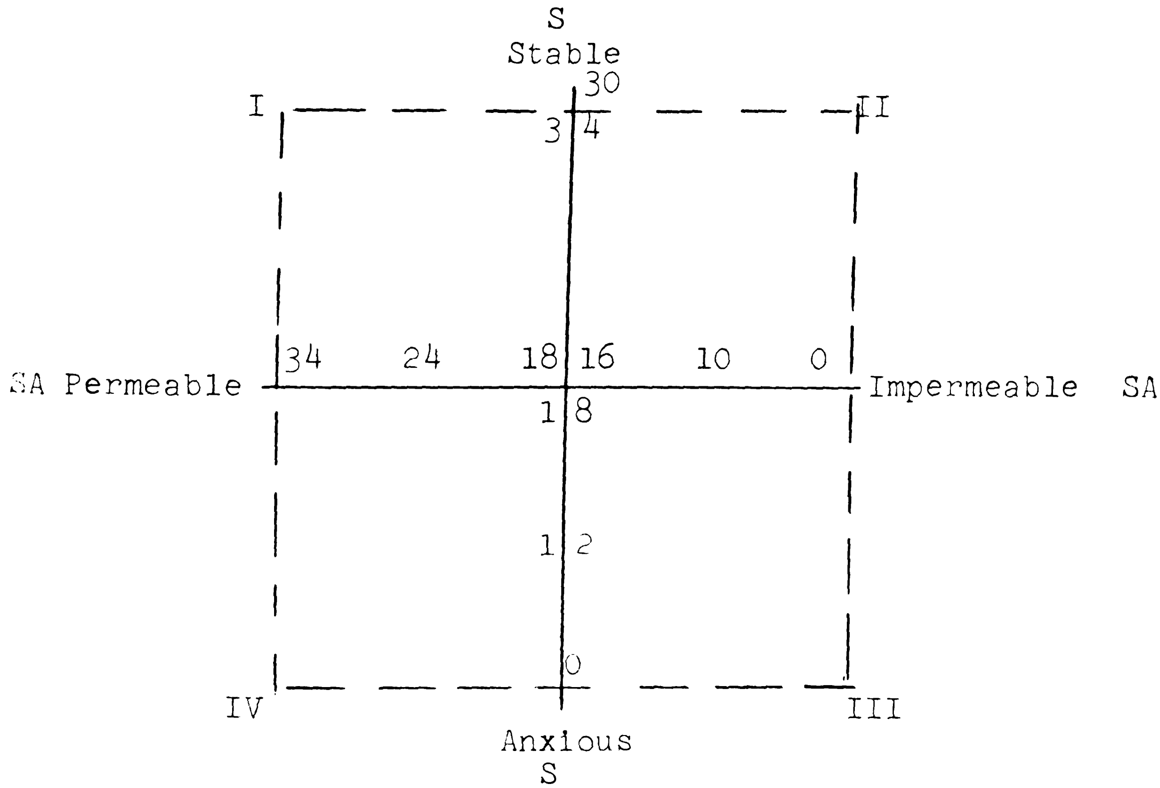


TABLE 3.7.--SA-S Senior and Junior Scales. Reliability Coefficients of Internal Consistency* (Split-half) and of Stability (test-retest, six weeks) for Upper Elementary and Junior High Students.

Grade	Type of Coefficient	N	SA	S
			r_{xx}	r_{xx}
Upper Elementary (Grades 4, 5, 6)	Split-half	221	.72	.84
	Test-retest	73	.61**	.77**

* Guttman L-4.
** Trial forms.

trained by the Michigan State University Human Energy Laboratory staff. Investigators included the training staff, university students and Pontiac physical education staff members. Recorders were university students and parents of pupils being tested. Directions for Anthropometric Testing are in the Appendix (Item 3).

4. a. Circumference sites.

Measurements were taken three times on the upper arm area (according to the relaxed arm method by Montagu, 29) and axillary girth was measured three times during normal inspiration and expiration. An average of each was recorded on data processing sheets. Circumference measurements were recorded to the nearest centimeter. Steel tapes were used.

4. b. Diameter sites.

Measurements were taken three times each from biacromial and bicristal sites. An average of each was recorded on data processing sheets. Diameter sites were recorded to the nearest centimeter. Sliding wooden calipers were used.

4. c. Skinfold sites.

Measurements were taken three times each on three sites: upper arm (triceps), subscapular (below tip of right scapula) and abdonem (one-third the distance from the right of the umbillicum to the iliac crest). An average of each was recorded on data processing sheets. Skinfold measurements were recorded to the nearest millimeter. Skinfold calipers were used.

4. d. Height.

Height was recorded to the nearest half-inch. The test subject was in stocking feet. Standard school scales with height bars were used.

4. e. Sitting height.

Measurements were recorded from the top of the head to the floor with the subject sitting on the floor with knees out and scapular and sacral regions against the wall. Sitting height was recorded to the nearest half inch. Yardsticks were taped against the wall for measuring.

4. f. Leg length.

Leg length was computed by finding the difference between standing and sitting heights.

4. g. Weight.

Weight was recorded to the nearest pound. The test subject was dressed in shorts and shirt or comparable clothing. Standard school scales were used.

4. h. Standard height and standard weight.

Norms were used from the Iowa Height-Weight Scales (Appendix Item 3a), which is accepted as norms or as standards at various age levels.

4. i. Relative height and relative weight.

Relative height was computed from the equation $\frac{100 \text{ actual height}}{\text{standard height}}$.

Relative weight was computed from the equation $\frac{100 \text{ actual weight}}{\text{standard weight}}$.

Standard heights and weights were obtained from the Iowa Height-Weight Norms (Appendix Items 4a, 4b), and from conversion tables (Appendix Item 4c).

4. j. Ponderal index.

Ponderal index was computed from the equation $\frac{\text{height}}{\sqrt[3]{\text{weight}}}$

5. Motor performance tests.

A test manual for physical performance tests (Appendix Item 4) was prepared by the Project "E" Director. This manual was used by investigators and recorders for physical performance tests. Investigators and recorders included Michigan State University staff and students, Pontiac Public Schools physical education staff and classroom teachers, and parents of pupils being tested.

Motor performance tests were given and recorded two times, with the best of two times recorded on data processing sheets. The pulse recovery rate test was the one exception. This test was given only once.

5. a. 40 yard dash.

The fitness component, "speed," was measured by the 40 yard dash on an outdoor grassy area. Three-foot lanes were marked and subjects simultaneously competed against a stop watch (usually two subjects at a time, or three or four subjects at a time depending on the number of investigators at a site). Restraining lines and finish lines were marked on the area. Measurements were taken to the nearest tenth of a second. Stop watches with tenth-second markings were used.

5. b. Standing broad jump.

The fitness components, "explosive leg power" and "strength", were measured by the standing broad jump. Tuft-hair mats, 8' x 4' x 2" were used for the broad jump. Markings were made by feet and inches (plastic tape and magic marker, respectively). A jumping board the height of the mat butted against the mat. The board was made of wood with striped rubber matting on the top for traction. These were made by the maintenance staff of the Pontiac Public Schools. Jumps were recorded to the nearest inch. Recordings were made indoors.

5. c. Softball throw for distance.

The softball throw for distance was used as a general strength and coordination measurement. Markings were made by yards with slash marks up to two-hundred feet. Restraining lines were marked. Recordings were taken to the nearest foot. Regulation eight-inch circumference softballs were used.

5. d. Grip strength.

Readings were taken on right and left hand grip strength. Two different hand dynometers were used, with one calibrated in pounds and the other in kilograms, so a table was made for converting pounds to kilograms. (Appendix Item 5). Recording was done in kilograms

5. e. Sit-reach.

"Flexibility" was the fitness component measured by the sit-reach test. Subjects sat on the floor, placing stockinged feet against the bench. Three reaches were permitted for each recording, with the third reach (bounce) recorded.

Plus or minus recordings were made to the nearest eighth of an inch. Equipment was made by the maintenance staff of the Pontiac Public Schools.

5. f. Eight-inch step test.

"Recovery rate and endurance" were measured by the eight-inch step cardio-vascular test. A pulse count was taken following two minutes of excerise and one minute of rest. Recordings were made by actual pulse count in one-half minute. The eight-inch platform was constructed by the maintenance staff of the Pontiac Public Schools. A metronome was used for timing and stop watches were used for starting and stopping subjects, for time lapses and for recording pulse rates.

6. General information.

General information was taken from class records or from parent-teacher conferences. This information included the subject's

6. a. Name--first, middle and last

6. b. Age--month, day, year

6. c. Race--white or Negro

6. d. Sex

6. e. Grade

6. f. Socio-economic status. Socio-economic status was recorded according to Warner's (39) job occupation scale. (Appendix Item 6a). This scale was translated into a classification scale according to the

Dictionary of Occupational Titles (Appendix Item 6b). The first scale, along with recording directions for the teacher was distributed by the Project "E" Director (Appendix Item 6c).

Code numbers were given by school to each subject and recorded by the teacher or by the person in charge of the master code sheets.

Methods of Procedure

It was considered advisable to conduct pre-tests in some areas where tests had not been proven reliable or valid:

1. The eight-inch step test was in question regarding the coordinative and timing ability of children at the first two grade levels to make a satisfactory, testable showing. Two unrelated (non-test) schools were selected, with two unrelated (non-test school) physical education teachers administering these tests under conditions similar to those in the proposed testing program. The judgment of teachers administering the tests was that first, second, and third grade children were capable of understanding and executing the test.
2. Various distances were tried for the dash in the same non-test schools on samples from grades one through six. The forty-yard dash was decided upon as the most satisfactory to determine a certain amount of

endurance and to determine speed in subjects grades one through six. Lesser distances seemed not to tax the older children sufficiently and greater distances were distracting to younger children. A similar judgment was made by the Michigan State University staff. Tests were made in different years and in different geographical locations which seemed to bear out these judgments.

3. An agility test was included in the original battery of motor performance tests, but was eliminated because it was not sufficiently understood by first and second grade children. By the time the test was understood the training element would have affected the performance. The test used was the three-line, four-foot apart taped distance. Each touched line counted a point during a ten-second test (McCloy, 26, pp.85, 86).

4. The SA-S Test for social approachability and emotional stability had not been validated or proven reliable at the first through third grade levels. The two physical education teachers of the control schools were asked to give this test to three classroom teachers, one in grade one, one in grade two and one in grade three in schools where they taught other than the control schools. Two other physical education teachers were asked to give the same test

to two other schools. The results of these pretests were considered and then measured against results of the experimental and control schools in final data analysis.

Prior to the actual testing involved in the study, plans were made to inform classroom teachers, school engineers, school secretaries, cafeteria personnel, physical education teachers and parents about the tests. Teacher orientation took place with the Director of Physical Education, Recreation, and Athletics (Project "E" Director) who presented plans for testing and recording at each school involved in the project (Appendix Items 2, 4,6,7,8). Meetings were held with parents who volunteered to serve as recorders. The first contact with parents was made through the principals of the three schools, followed by meetings between the Director and the parents.

Michigan State University students were trained for testing by staff members of the Human Energy Laboratory, who worked with students from the Tests and Measurements Classes. Students were instructed in measurement techniques on anthropometric data, the cardio-vascular test and the grip-strength test (Appendix Item 8b). Students were given directions for motor ability testing (Appendix Item 4). Twenty-five to fifty students were involved each day in the testing, along with Pontiac

physical education teachers, classroom teachers and ten to twenty-five parents at each school.

Materials for instructions and actual testing were formulated, compiled and duplicated through the Pontiac Schools Physical Education Office: *Project "E"--A Test Manual for Physical Performance Tests* (Appendix Item 4); "SA-S" tests with the directions, scoring sheets and manuals (Appendix Items 2); directions for classifying and recording socio-economic status (for classroom teachers) (Appendix Items 6); data sheets for general information, anthropometric measurements and motor performance tests (Appendix Item 7). These materials were given to each test school. Each school had ataa sheets of a different color for easier discrimination in the compilation of total data, and each school was given its own code number.

Motor performance and anthropometric tests were conducted on separate days in each of the schools. These tests were scheduled during one week in the fall and during one week in the spring, with tests taking place for one full school day at each of the three test schools. Academic and social tests were given at the classroom teacher's discretion within a given six-week limitation.

Plans were formulated and drawn up for the building of equipment and the readying of facilities for the tests.

The maintenance staff of the Pontiac Public Schools constructed, according to specification, sit-reach benches, jumping boards and step-test platforms. Other equipment used in testing was either platforms. Other equipment used in testing was either purchased or borrowed.

Books used most frequently for test design and test selection were authored McCloy (26), Montague (29), Brown (51) and Espenschade (66).

Floor designs were made to facilitate traffic flow and to recognize quickly testing station locations. Engineers were informed about set-ups and take-downs, and they worked along with investigating personnel and maintenance staff members to move equipment in a minimum of time. School cafeteria personnel was consulted concerning food arrangements for the investigating personnel on the days that motor perofmrance and anthropometric tests and measurements were scheduled at their schools. Progress reports were made from time to time to the superintendent's office and to schools (Appendix Items 8).

Methods of Analyzing Data

The usual procedures of data transfer onto IBM cards was followed. Data tabulation, key punching and a verification process was completed in Pontiac, using school personnel. Computer programming and processing were done at Michigan State University.

Each student tested had four IBM cards. Cards were color-keyed by number and by school for easier identification and interpretation.

Card items were punched as shown by the following four illustrations:

Illustration 3.2. Card No. 1 and 3 (test and re-test, respectively), Grades 3-6.

Column Number	Item
1, 2	Card number
3, 4	Test month
5, 6	Test year
7	School
8, 9, 10	Code number of subject
11, 12	Birth month
13, 14	Birth year
15, 16	Grade
17	Sex
18	Race
19, 20	Socio-economic occupation
21	Socio-economic class
22, 23, 24	I.Q.
25, 26	Academic vocabulary
27, 28	Reading comprehension
29, 30	Total language
31, 32	Total work study
33, 34	Total arithmetic
35, 36	Composite
37, 38	Social rating
39, 40	Emotional scale
41, 42, 43	Actual height
44, 45, 46	Actual weight
47, 48, 49	Sitting height
50, 51, 52	Triceps skinfold
53, 54, 55	Subscapular skinfold
56, 57, 58	Abdomen skinfold
59, 60, 61	Upper arm circumference
62, 63, 64	Chest inspiration
65, 66, 67	Chest expiration
68, 69, 70	Biacromial diameter
71, 72, 73	Bicristal diameter
74, 75, 76	Standard weight
77, 78, 79	Relative weight

Illustration 3.3. Card No. 1 and 3 (test and re-test, respectively) Grade 2.

Column Number	Item
1, 2	Card number
3, 4	Test month
5, 6	Test year
7	School
8, 9, 10	Code number of subject
11, 12	Birth month
13, 14	Birth year
15, 16	Grade
17	Sex
18	Race
19, 20	Socio-economic occupation
21	Socio-economic class
22, 23, 24	I.Q.
25, 26	Word knowledge
27, 28	Word discrimination
29, 30	Reading
31, 32	Spelling
33, 34	Total arithmetic
35, 36	Composite
37, 38	Social rating
39, 40	Emotional scale
41, 42, 43	Height (actual)
44, 45, 46	Weight (actual)
47, 48, 49	Sitting height
50, 51, 52	Triceps skinfold
53, 54, 55	Subscapular skinfold
56, 57, 58	Abdomen skinfold
59, 60, 61	Upper arm circumference
62, 63, 64	Chest inspiration
65, 66, 67	Chest expiration
68, 69, 70	Biacromial diameter
71, 72, 73	Bicristal diameter
74, 75, 76	Standard weight
77, 78, 79	Relative weight

Illustration 3.4. Card No. 1 and 3 (test and re-test, respectively) Grade 1.

Column Number	Item
1, 2	Card number
3, 4	Test month
5, 6	Test year
7	School
8, 9, 10	Code number of subject
11, 12	Birth month
13, 14	Birth year
15, 16	Grade
17	Sex
18	Race
19, 20	Socio-economic occupation
21	Socio-economic class
22, 23, 24	I.Q.
25, 26	- -
27, 28	- -
29, 30	- -
31, 32	- -
33, 34	- -
35, 36	Total readiness
37, 38	Social rating
39, 40	Emotional scale
41, 42, 43	Height
44, 45, 46	Weight
47, 48, 49	Sitting height
50, 51, 52	Triceps skinfold
53, 54, 55	Subscapular skinfold
56, 57, 58	Abdomen skinfold
59, 60, 61	Upper arm circumference
62, 63, 64	Chest inspiration
65, 66, 67	Chest expiration
68, 69, 70	Biacromial diameter
71, 72, 73	Bicristal diameter
74, 75, 76	Standard weight
77, 78, 79	Relative weight

Illustration 3.5. Card No. 2 and 4 (test and re-test, respectively), Grades 1-6.

Column Number	Item
1, 2	Card number
3, 4	Test month
5, 6	Test year
7	School
8, 9, 10	Code number of subject
11, 12, 13	40 yard dash
14, 15	Standing broad jump
16, 17, 18	Softball throw
19, 20	Right hand grip strength
21, 22	Left hand grip strength
23, 23, 25, 26	Sit-reach
27, 28	Cardio-vascular pulse count
29, 30	- -
31, 32	- -
33, 34	- -
35, 36, 37	Sum of fat measurements
38, 39, 40	Difference--expiration and inspiration
41, 42	Standard height
43, 44, 45	Sum--left and right grip
46, 47, 48	Leg length
49, 50, 51	Relative height
52, 53, 54	Ponderal index

Prior to developing the computer program, a transformation program was written so that additional information could be punched onto the cards. This program included computing and punching the items: (1) relative height, (2) relative weight, (3) ponderal index, (4) sum of fat measurements, (5) difference between inspiration and expiration, (6) leg length, (7) sum of right and left grip strength and (8) socio-economic classification from socio-economic occupational level.

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Data are analyzed in this chapter. Normative data, intercorrelations and clusters are analyzed, then interpreted by means of charts, graphs and illustration.

Normative Data

Normative data was obtained from the Test Data (first tests, given in October of 1963). Norms are cited on the white population only. (It is generally accepted by researchers in child growth and development that motor performance responses differ between races. It could, therefore, confuse facts and findings if the population were treated as one.) Pertinent information obtained included means and standard deviations.

Only those subjects with complete data recorded were used in final programming, and only those variables were included from which analysis could be made. When listing means and standard deviations, numbers were carried to the nearest decimal.

Norms were obtained by sex and age (according to the Age Chart, Appendix Item 3c, Table 6.2 on:

1. Academic achievement
2. Social and emotional behavior

3. Anthropometric measurements
4. Motor performance

Age groups, rather than grade levels were used in this normative plotting, so that age requirement for entrance into the Pontiac Public Schools and age spread found with grade levels was considered (see Age Chart Appendix Item 3c Table 6.2).

The following charts and graphs are illustrative of data interpretation. Number, Means and standard deviations for each of the variables can be found in the Appendix (Item 10, Tables 6.5-6.8).

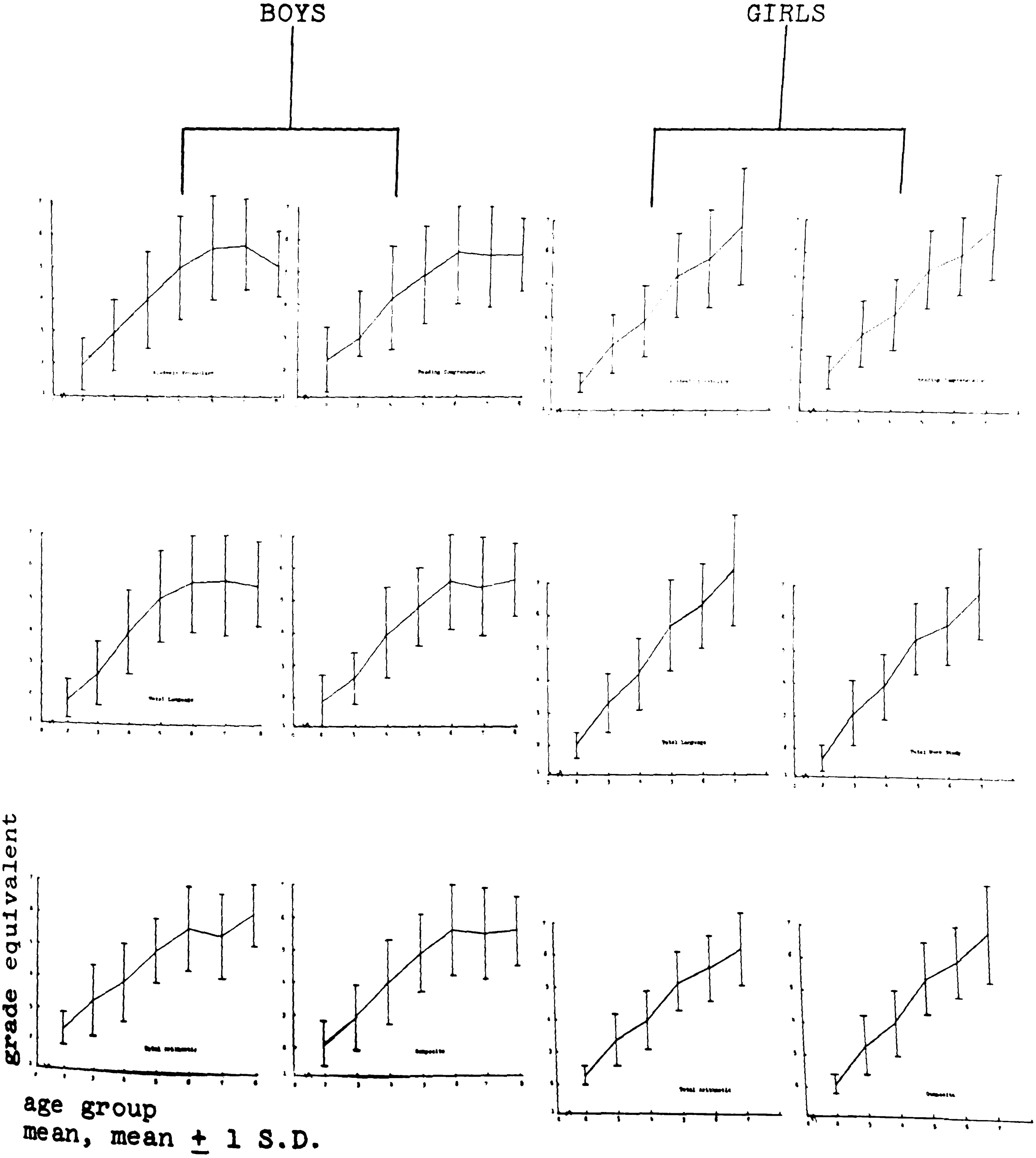
Due to an error in computer programming, the sit-reach test was eliminated in the analysis of data.

Academic achievement was graphed as an example of data interpretation. The graph method could be used for eventual comparative purposes, since it shows achievement for each age group and anticipated growth between age groups.

The following graphs in Illustration 4.1 show academic achievement of boys and girls as labelled, plus or minus one standard deviation. Age groups are located on the horizontal axis; grade equivalency is located on the vertical axis.

In all areas of academic achievement, girls showed an increase in achievement level with an increase in age. Boys showed an increase in achievement level with an increase in age through age group six. In age group eight, boys showed a drop from age group seven in

Illustration 4.1--Academic Achievement Tests: Iowa Basic Skills Tests, Metropolitan Reading and Readiness Tests.



vocabulary and total language; in age group seven there was a drop from age group six in total work study and composite score; and there was a maintained level of achievement at age levels seven and eight in reading comprehension.

SA-S Tests were explained in some detail in Chapter III, pp.44-45. Another summary at this point, however, will aid in understanding numerical recordings and graphic illustrations. The horizontal line represents the "SA" or social approachability of the test. "34" represents most permeability and "0" represents most impermeability. The vertical line represents the "S" or emotional stability aspect of the test. "34" represents most stability and "0" represents most anxiety. Quadrants, therefore, represent a combination of social approachability and emotional character of the subjects.

SA-S terms were defined in Chapter III, p.46. Further quadrant definitions are as follows:

<u>Quadrant I</u>--permeable, stable--sociable, talkative, irresponsible and impulsive unless patterned, prefers direction, lax conscience, fickle social relationships, expressive, emotionally responsive, tendency to learn less and less about more and more.

<u>Quadrant II</u>--impermeable, stable--serious, mature, conscientious, reserved, individualistic, methodical, relatively inflexible, over-achiever, self-confident, fixed.

Quadrant III--impermeable, anxious--overly conscientious, reactionary, rigid, withdrawn, suspicious of others, follows strong leadership, hypothyroid, stolid, lethargic, cautious, difficulty in reading, overorganized, must let loose of constricting patterns he owns.

Quadrant IV--permeable, anxious--clinging dependency, gullible, disorganized under stress, anxiety heightens emotions, cycloid, emotionally responsive, sensitive to social disapproval, lacks self-confidence, not conscientious, underachiever, needs patterned direction.

The two aspects of personality, designated by the horizontal and vertical axes, were considered to be important factors to success in school and other achievement situations. Measures were derived from several studies of personality differences. The four quadrants were obtained by intercorrelating personality profiles and from a cluster analysis of the matrix.

According to the graphs (Illustration 4.2) all boys and girls in all age groups fall into Quadrant IV. This means, by definition, that they are permeable-anxious. The nearer the mid-line, the nearer they are to other quadrants, which indicates the degree of permeability and anxiety and the degree of characteristics assumed from another quadrant.

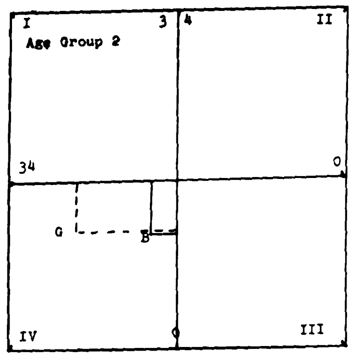
At this time, there is no known explanation for all of one subjects falling into one quadrant.

The following graphs, Illustration 4.2, show age grouping patterns, with boys and girls of like age groupings plotted on the same graph.

Illustration 4.2--SA-S Tests.

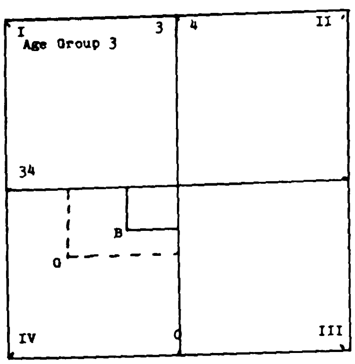
Boys S M = 12.5
Girls M = 12.7

SA
Boys M = 18.8
Girls M = 25.5



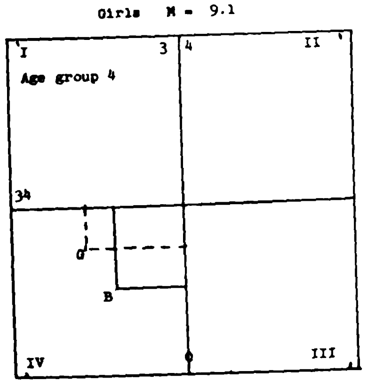
Boys S M = 13.1
Girls M = 11.0

SA
Boys M = 22.5
Girls M = 26.4



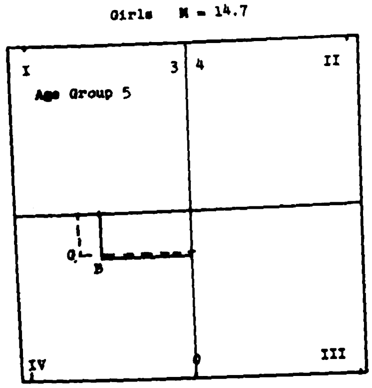
Boys S M = 13.9
Girls M = 9.1

SA
Boys M = 23.6
Girls M = 25.1



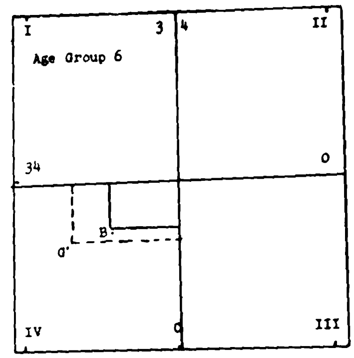
Boys S M = 14.2
Girls M = 14.7

SA
Boys M = 23.7
Girls M = 27.3



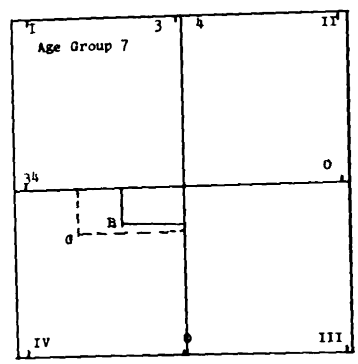
Boys S M = 14.3
Girls M = 12.2

SA
Boys M = 23.5
Girls M = 26.5



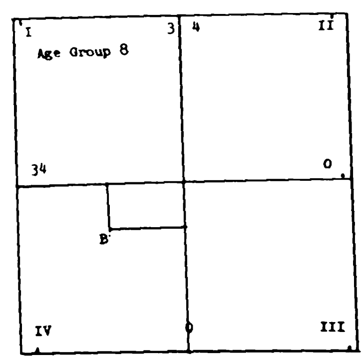
Boys S M = 15.2
Girls M = 13.4

SA
Boys M = 23.1
Girls M = 26.0



Boys S M = 14.4

SA
Boys M = 24.2



Anthropometric data are graphed according to components, sums, differences or indices (Illustration 4.3), with increments shown on each graph in like calibrations. In order, acccording to calibration, graphs show height (in inches), weight (in pounds), sum of fat measurements (in millimeters), upper arm circumference (in centimeters), difference between chest inspiration and expiration (in centimeters) and biacromial and bicristal diameters (in centimeters). These measurements are shown on the left hand side of each graph.

Actual measurement is shown by the solid line; increment is shown by the dotted line. Increment is shown by per cent, and is to be read according to the scale on the right hand side of each graph. The increment line shows the percentage of growth between age groups. Age groups are located on the horizontal line.

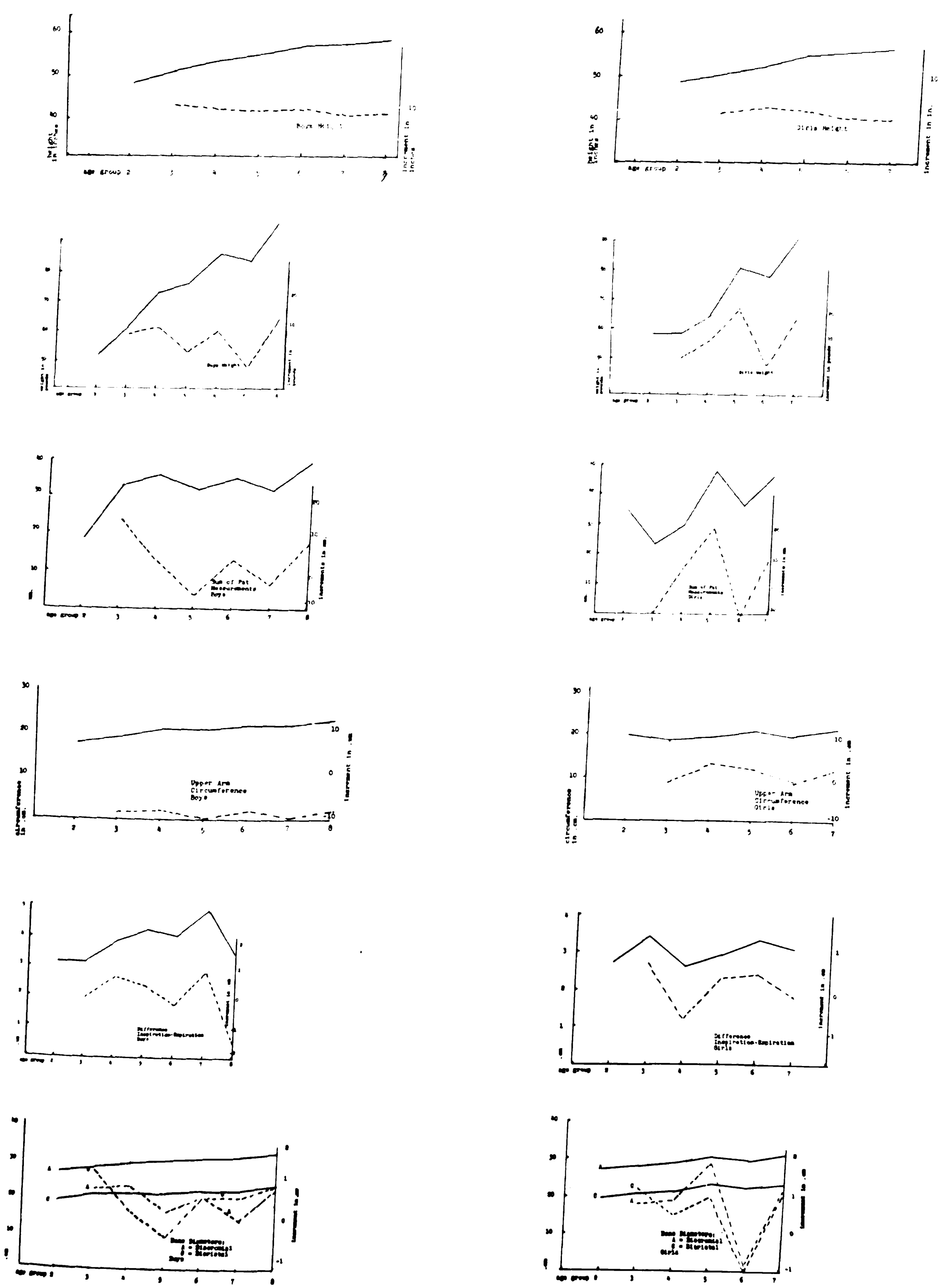
The following graphs, Illustration 4.3, show anthropometric measurements of boys and girls according to age groupings, and they show increment in growth.

It will be noted that both boys and girls showed an increase in height with an increase in age, but that the increment was greatest between age groups two and three for boys, and between age groups four and five for girls.

Boys showed an increase in weight with an increase in age except between age groups six and seven, where there was a decrease; the greatest increment was between age groups seven and eight. Girls showed an increase in

Illustration 4.3--Anthropometric Data.

BOYS GIRLS



weight except between age groups two and three (which showed a slight decrease) and age groups five and six; the greatest increment was found between age groups four and five.

The sum of fat measurements indicated an increase with age for boys with two exceptions--there was a decrease between age groups four and five and between age groups six and seven; the greatest increment was between age groups two and three. The sum of fat measurements for girls showed an increase with age with two exceptions--there was a decrease between age groups two and three and age groups five and six; the greatest increment was between age groups four and five.

Upper arm circumference for boys increased with age except between age groups four and five, where it was maintained. Girls showed increases with two exceptions. There were decreases between age groups two and three and age groups five and six.

There was an increase in difference in chest inspiration-expiration for boys between age groups three and four, groups four and five, and groups six and seven; there was a decrease between age groups five and six and groups seven and eight; the difference was maintained between age groups two and three. Girls showed an increase in chest inspiration-expiration difference between all age groups except two where there was a decrease between age groups three and four and between age groups six and seven.

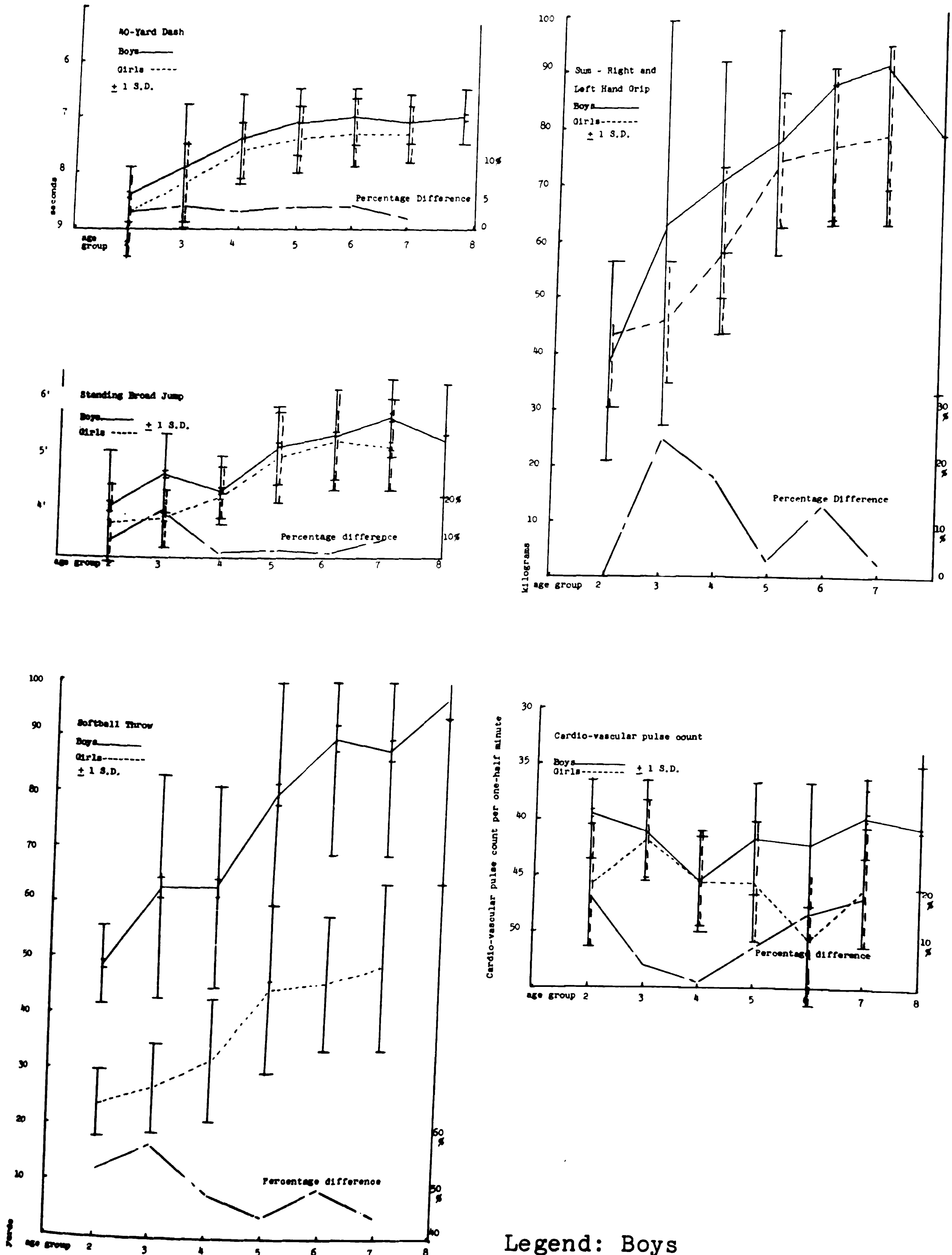
Boys showed increasingly greater measurement in all bicromial bone diameter with an increase in age groups.

Girls showed increasingly greater measurement with the exception of age groups five and six, where there was a lesser measurement in biacromial bone diameter. Boys showed increasingly greater measurement in bicristal bone diameter in age groups two and three, four and five, five and six, seven and eight; there was a lesser measurement between age groups four and five, and the measurement was the same between age groups six and seven. Girls showed increasingly greater measurement in bicristal bone diameter with an increase in age groups with the exception between age groups five and six, where there was a lesser measurement in bicristal bone diameter. (It will be noted here, however, that measurements were not longitudinal, but were taken on different subjects at different ages).

Motor performances were illustrated according to each measurement in the following graphs, Illustration 4.4. Each of the graphs can serve as a norm for eventual comparative purposes (comparing one student or one age group against a particular graph). In eventual comparsions, it is probable that separate charts would be used for boys and for girls. The percentage of difference is shown between boys and girls. Each graph also shows plus and minus one standard deviation from each measurement.

In order, according to calibrations, graphs show 40-yard dash (in seconds and tenths), standing broad jump (in feet and inches), softball throw (in yards), sum of right and left hand grip strength (in kilograms), and

Illustration 4.4--Motor Performance.



Legend: Boys ——
Girls -----
Percentage Difference- — —

pulse recovery rate (pulse count for one half minute taken after a one-minute rest following the two minute step test).

Calibrations of measurements are shown on the left hand side of the graphs. Percentage of difference between boys and girls is shown on the right hand side of the graph. Age groups are shown on the horizontal axis.

A difference in motor performance between boys and girls was noted: boys scored higher at all age groups in the 40-yard dash; the standing broad jump; the softball throw; the right and left total grip with the exception of age group two, where girls scored higher; and in the pulse recovery rate.

Intercorrelations and Clusters

Interrcorrelations were obtained on all pre-test variables by age and sex on:

1. Academic achievement (academic vocabulary, reading comprehension, total language, total work study, total arithmetic and academic composite);
2. SA-S results (social approachability and emotional stability);
3. Anthropometric measurements (actual height, sitting height, leg length, standard height, relative height, actual weight, standard weight, relative weight, ponderal index, triceps skinfold, subscapular skinfold, abdominal skinfold, sum of fat measurements, upper arm circumference, chest inspriation,

chest expiration, difference between chest inspiration and expiration, biacromial diameter and bicristal diameter);

4. Motor performance (40-yard dash, standing broad jump, softball throw, sit-reach, right grip strength, left grip strength, sum of right and left grip strength and pulse recovery rate).

Pertinent information on intercorrelations included number, means, standard deviations and correlation coefficients. Number, means and standard deviations for variables are found in the Appendix (Items 10, Table 6.5-6.8).

Matrices on the following pages, Tables 4.2-4.16, show correlations for all variables according to age and sex. Underlined correlations represent significance at the .05 level (according to Edwards, 15, p. 502). This level along with the number of subjects is shown on each matrix.

Cluster diagrams were made from each matrix, based on McQuitty's (101) pattern for elementary linkage analysis. Some variables were ignored for the purpose of obtaining clusters which could show interrelationships, over and above obvious clusters within certain areas. For example, variable six (academic composite) was omitted because existing relationships to its components have been established in previous test analysis. For

this reason (established relationships), certain variables were omitted in the cluster illustrations. These were variable #6 (academic composite), #17 (chest expiration, because of its known relationships to chest inspiration and to the difference between chest inspiration and expiration), #20 (standard weight, becuase it was not a direct measurement of the subject, but was used for computing relative weight), #21 (relative weight, because it has an acknowledged relationship to actual weight), #26 (left grip strength, because of its known relationship to right grip strength and to the sum of right and left grip strengths), #27 (sit-reach agility test, because of an error in computer programming of + and - measurements), #29 (sum of fat measurements, because of the acknowledged relationship to its components--subscapular, triceps and abdominal skinfold measurements), #30 (difference between chest expiration and inspiration, because of its acknowledged relationship to each of those components), #31 (standard height because it was not a direct measurement of the subject, but was used for computing relative height), #32 (sum of left and right grip strength, because of its acknowledged relationship to each of those components), #34 (relative height, because it has an acknowledged relationship to actual height), and #35 (ponderal index, becuąse it is a computation of heights and weights, and thus has an acknowledged relationship to each).

Cluster diagrams illustrate maximized relationships of factors (or the best combination) of factors (variables). An analysis was made for each age group, but all clusters were not to be commented upon because of some of the obvious and known clusters (e.g., within the academic area). Motor performance factors are illustrative of general motor performance capacity, according to research in the field of motor performance tests:

1. The right hand grip strength is reasonably indicative of total physical strength.
2. The 40-yard dash reflects power, coordination and speed of muscular contraction.
3. The softball throw reflects power and coordination.
4. The standing broad jump measures explosive power
5. The pulse rate recovery measures cardio-vascular adaptation to endurance activities.
6. The combination of dash and broad jump measures muscular power and speed of muscular contraction.

Cluster diagrams (Illustrations 4.5-4.19) are presented immediately following each matrix.

The following table, Table 4.1, presents an overview of cluster groupings for boys and girls at each age level. The four general test areas are listed as (1) academic, (2) social, (3) anthropometric and (4) motor, and they are listed with all their combinations.

TABLE 4.1--Cluster Analysis--Boys and Girls at All Age [illegible]

	B2	B3	B4	B5	B6	B7	B8	[illegible]	[illegible]	[illegible]	[illegible]	G6	G7
Academic	X			X	X	X	X	X	X				X
Social					X							X	
Anthropometric		X	X		X	X		X	X	X	X	X	
Motor	X		X	X	X	X					X	X	X
Academic-Social						X					X		X
Academic-Anthropometric													
Academic-Motor			X				X			X		X	
Socio-Anthropometric			X						X				
Socio-Motor			X				X				X		
Anthropometric-Motor		X		X	X	X		X	X	X	X		X
Academic-Socio-Anthropometric								X					
Academic-Socio-Motor		X						X					
Academic-Anthropometric-Motor													
Socio-Anthropometric-Motor	X			X		X	X						
Academic-Socio-Anthropometric-Motor													

TABLE 4.2--Correlation Matrix for Boys, Age Group 2.

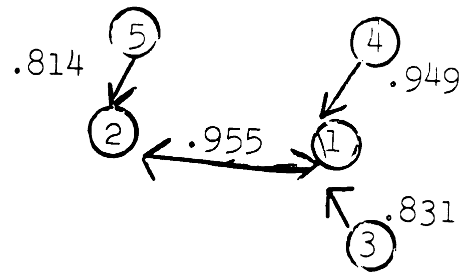
Variable	1	2	3	4	5	6	7	8	9	10	11	12
1 Academic Vocabulary	1.000	.283	.831	.643	.718	[illegible]	-.069	-.018	.265	[illegible]	.337	.204
2 Reading Comprehension		1.000	.816	.850	.611	[illegible]	-.176	-.180	.119	.078	.242	-.046
3 Total Language			1.000	.770	.469	[illegible]	.081	-.366	-.108	-.057	-.128	-.144
4 Total Work Study				1.000	.648	[illegible]	-.003	-.192	.438	.289	.433	.141
5 Total Arithmetic					1.000	.776	-.093	-.242	.381	.263	.451	-.066
6 Academic Composite						1.000	-.047	-.223	.239	.133	.299	.052
7 Social Rating							1.000	.061	.404	.169	.159	.405
8 Emotional Scale								1.000	.026	.522	.043	.528
9 Actual Height									1.000	.721	.849	.549
10 Actual Weight										1.000	.770	.517
11 Sitting Height											1.000	.543
12 Triceps Skinfold												1.000

Variable	13	14	15	16	17	18	19	20	21	22	23	24
1 Academic Vocabulary	.360	.123	.156	-.042	-.043	-.004	.437	-.273	.156	.187	[illegible]	.178
2 Reading Comprehension	.266	-.029	.233	[illegible]	.014	-.009	.306	-.367	.134	.106	.140	[illegible]
3 Total Language	-.034	-.146	.086	[illegible]	-.201	-.253	.082	-.516	-.176	.384	[illegible]	[illegible]
4 Total Work Study	.466	.305	.220	[illegible]	.041	.203	.579	-.272	.319	.157	[illegible]	.317
5 Total Arithmetic	.110	.073	.231	.061	.207	.312	.311	-.219	.273	-.227	[illegible]	[illegible]
6 Academic Composite	.286	.095	.218	-.002	[illegible]	.039	.399	-.357	.172	.169	[illegible]	.243
7 Social Rating	-.087	.586	.235	[illegible]	.321	.119	.099	-.194	.172	.441	[illegible]	.427
8 Emotional Scale	.209	.409	.444	[illegible]	.234	.219	.276	.141	.486	.160	-.245	-.130
9 Actual Height	.406	.857	.075	[illegible]	.418	.671	.703	.213	.649	-.147	.396	[illegible]
10 Actual Weight	.547	.781	.544	[illegible]	.729	.861	.859	-.050	.757	-.335	[illegible]	[illegible]
11 Sitting Height	.702	.643	.171	[illegible]	.467	[illegible]	.715	.077	.722	-.410	[illegible]	.168
12 Triceps Skinfold	.557	.787	.011	.278	.201	.215	.515	.133	.478	.074	-.285	-.013
13 Subscapular Skinfold	1.000	.591	.233	.207	.218	.242	.583	-.061	.542	-.042	[illegible]	[illegible]
14 Abdominal Skinfold		1.000	.290	[illegible]	.530	.585	.685	.080	.723	.088	.105	.427
15 Upper Arm Circumference			1.000	.662	.827	.373	.274	-.558	.614	.234	.342	.117
16 Chest Inspiration				1.000	.782	.740	.544	.060	[illegible]	-.278	[illegible]	.346
17 Chest Expiration					1.000	.637	.441	-.171	.784	-.052	.442	.323
18 Biacromial Diameter						1.000	.714	-.119	.869	-.570	.727	.544
19 Bicristal Diameter							1.000	-.015	.842	-.399	[illegible]	[illegible]
20 Standard Weight								1.000	.257	-.078	[illegible]	[illegible]
21 Relative Weight									1.000	-.333	-.470	.277
22 4-Yard Dash										1.000	[illegible]	.013
23 Standing Broad Jump											1.000	.676
24 Softball Throw												1.000

Variable	25	26	27	28	29	30	31	32	33	34	35
1 Academic Vocabulary	[illegible]	[illegible]	.226	.321	.166	-.135	[illegible]	.166	.069	.365	.164
2 Reading Comprehension	[illegible]	[illegible]	.341	.230	.032	-.243	[illegible]	[illegible]	-.078	.221	.044
3 Total Language	[illegible]	[illegible]	.124	.400	-.124	-.417	[illegible]	[illegible]	-.039	.044	.214
4 Total Work Study	.366	[illegible]	.294	.391	.270	-.052	-.488	[illegible]	.264	.538	.165
5 Total Arithmetic	.134	-.011	.480	[illegible]	-.001	-.114	[illegible]	.056	.140	.436	.100
6 Academic Composite	.271	[illegible]	[illegible]	.269	.113	-.227	-.564	.148	.069	.350	[illegible]
7 Social Rating	-.103	-.151	-.284	-.370	.416	-.486	-.308	-.130	.534	.469	[illegible]
8 Emotional Scale	-.384	[illegible]	.377	-.423	.445	-.091	.344	-.343	-.065	-.048	-.711
9 Actual Height	[illegible]	-.217	.093	.243	[illegible]	.314	.176	-.149	.779	[illegible]	[illegible]
10 Actual Weight	.139	.083	.346	-.195	.661	.084	.161	.109	[illegible]	[illegible]	-.448
11 Sitting Height	.018	-.104	-.067	-.070	.677	.272	.134	-.049	.317	.846	.001
12 Triceps Skinfold	[illegible]	-.562	-.233	-.316	[illegible]	.102	.187	-.560	.330	[illegible]	-.087
13 Subscapular Skinfold	[illegible]	-.140	-.298	.336	.701	.195	.059	-.079	.041	[illegible]	-.072
14 Abdominal Skinfold	[illegible]	-.293	-.056	-.298	.906	.066	.120	-.248	.702	.848	.002
15 Upper Arm Circumference	.370	.300	.391	-.069	.151	-.655	-.332	.335	-.072	.139	-.178
16 Chest Inspiration	[illegible]	-.040	.449	-.475	.413	-.063	[illegible]	-.012	.298	.509	-.467
17 Chest Expiration	[illegible]	.020	.437	-.471	.351	-.364	[illegible]	.049	.205	.417	-.508
18 Biacromial Diameter	.340	.289	.428	-.169	.365	.177	.079	.315	.450	.667	-.353
19 Bicristal Diameter	.277	.287	.251	.118	.640	.218	-.028	[illegible]	.303	.720	-.320
20 Standard Weight	-.543	-.499	-.009	-.332	.089	.743	.867	-.624	.290	[illegible]	.275
21 Relative Weight	[illegible]	.169	.346	-.130	.626	[illegible]	[illegible]	.194	.273	.655	-.536
22 4-Yard Dash	-.184	[illegible]	-.166	-.003	.082	-.525	-.282	-.214	.142	-.147	.239
23 Standing Broad Jump	.547	.473	.434	-.155	-.162	-.221	-.330	.511	.338	.426	-.097
24 Softball Throw	.117	.010	.470	-.404	.077	.000	-.074	.059	.845	.607	.283
25 Right Grip Strength	1.000	[illegible]	.189	.670	-.386	-.206	[illegible]	[illegible]	-.138	.047	-.189
26 Left Grip Strength		1.000	.213	.642	-.463	-.187	-.537	.903	-.264	-.119	-.321
27 Sit-Reach			1.000	-.298	-.210	-.060	.062	[illegible]	.085	-.009	-.508
28 Cardio-Vascular Count				1.000	[illegible]	[illegible]	-.458	.661	-.353	-.160	.052
29 Sum of Fat Measurements					1.000	.113	.160	-.476	.431	.676	-.074
30 Difference-Inspiration-Expiration						1.000	.687	-.197	.236	.189	.235
31 Standard Height							1.000	-.567	-.149	-.011	-.039
32 Sum of Right-Left Grip								1.000	-.208	-.043	-.263
33 Leg Length									1.000	.754	.465
34 Relative Height										1.000	.271
35 Pondered Index											1.000

Illustration 4.5 Cluster Analysis on Boys, Age Group 2.

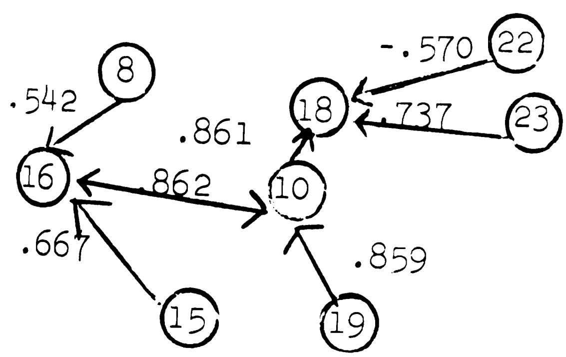
First Cluster of Variables



Number and Name of Variable

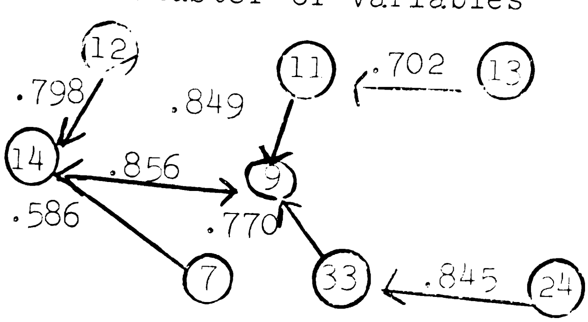
2 reading comprehension
1 academic vocabulary
5 arithmetic
4 work study
3 language

Second Cluster of Variables



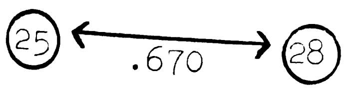
16 chest inspiration
10 weight
15 upper arm circumference
8 emotional stability
18 biacromial diameter
19 bicristal diameter
22 40 yard dash
23 standing broad jump

Third Cluster of Variables



14 abdominal skinfold
9 height
12 triceps skinfold
7 social approachability
11 sitting height
33 leg length
13 subscapular skinfold
24 softball throw

Fourth Cluster of Variables



25 right grip strength
28 pulse recovery rate

Observing correlation coefficients in Table 4.2 (boys, age group two), the range in value was between .989 and -.711. The highest positive correlation was between variables #1 (academic vocabulary) and #6 (composite academic achievement). The highest positive positive correlation between an academic and a variable in another area was .579, variables #4 (work study) and #19 (bicristal diameter). The highest negative correlation was between variables #8 (emotional stability) and #35 (ponderal index). Significance at the .05 level was .576 for this age group.

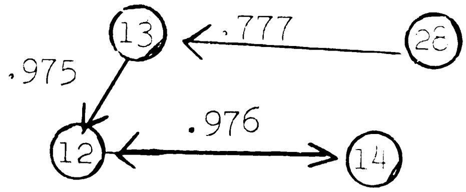
The cluster analysis on boys, age group two (Illustration 4.5) showed area clustering of the variables: academic, anthropometric-sociomotor, and motor. The first cluster showed only academic variables. The second cluster showed groupings of bone structure and weight (body size) with standing broad jump, which is indicative of explosive leg power and strength. In this cluster the negative correlation of the 40-yard dash to bone structure would indicate that heavy-structured boys at this age level would be faster in speed performance (the time scale is reversed). The clustering of emotional stability with chest inspiration was not accounted for on the basis of this data. (However, according to Walker, (Chapter II, p. 16,) there is evidence of relationships between body structure and emotional behavior). It was noted that the softball throw, which

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1 Academic Vocabulary	[illegible]																																		
2 Reading Comprehension	[illegible]	1.000																																	
3 Total Language	.784	[illegible]	1.000																																
4 Total Work Study	[illegible]	[illegible]	[illegible]	1.000																															
5 Total Arithmetic	.876	[illegible]	[illegible]	[illegible]	1.000																														
6 Academic Composite	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.000																													
7 Social Rating	.266	.165	.358	.360	.230	[illegible]	1.000																												
8 Emotional Scale	.697	[illegible]	[illegible]	.610	[illegible]	.786	[illegible]	1.000																											
9 Actual Height	[illegible]	.735	[illegible]	[illegible]	.58?	.653	.330	.565	1.000																										
10 Actual Weight	.463	[illegible]	.544	.616	.538	[illegible]	[illegible]	.604	.886	1.000																									
11 Sitting Height	.328	.474	[illegible]	[illegible]	[illegible]	.352	.201	.272	.868	.752	1.000																								
12 Triceps Skinfold	-.190	-.291	-.297	-.121	.030	-.194	.105	-.054	-.110	.038	-.162	1.000																							
13 Subscapular Skinfold	-.249	-.355	-.417	-.231	-.040	-.280	-.016	-.187	-.175	-.085	-.167	.975	1.000																						
14 Abdominal Skinfold	-.305	-.356	-.385	-.231	-.064	-.290	.045	-.151	-.083	.077	-.102	.976	.065	1.000																					
15 Upper Arm Circumference	.156	.206	.297	[illegible]	.385	.314	[illegible]	.382	.537	.832	.391	.307	.176	.382	1.000																				
16 Chest Inspiration	.334	[illegible]	[illegible]	[illegible]	.475	.469	.208	.516	.890	[illegible]	.787	.173	.094	.229	.807	1.000																			
17 Chest Expiration	[illegible]	.284	[illegible]	.279	.266	.229	.320	.350	[illegible]	.886	[illegible]	[illegible]	.096	[illegible]	[illegible]	[illegible]	1.000																		
18 Biacromial Diameter	.216	.466	.483	.498	[illegible]	.409	.157	.419	.835	[illegible]	.714	-.071	-.163	.009	.678	.860	.783	1.000																	
19 Bicristal Diameter	.122	.328	.275	[illegible]	[illegible]	.240	.278	.289	.674	[illegible]	.713	.015	-.097	.099	.766	.832	.933	[illegible]	1.000																
20 Standard Weight	.045	.139	[illegible]	.306	[illegible]	.268	.003	.323	.316	[illegible]	.129	.085	.012	.082	.503	.456	[illegible]	.443	.220	1.000															
21 Relative Weight	.482	.645	[illegible]	[illegible]	[illegible]	[illegible]	.416	.574	[illegible]	[illegible]	.784	[illegible]	-.098	.063	.777	[illegible]	.867	.838	.872	.230	1.000														
22 40-Yard Dash	[illegible]	[illegible]	-.541	[illegible]	[illegible]	[illegible]	-.370	[illegible]	[illegible]	[illegible]	-.392	.192	.191	.304	[illegible]	-.283	-.053	-.186	-.064	-.111	.261	1.000													
23 Standing Broad Jump	.341	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.224	.136	-.018	.058	[illegible]	-.504	-.135	-.398	-.356	-.369	[illegible]	-.209	[illegible]	1.000												
24 Softball Throw	.243	.370	[illegible]	.463	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.549	[illegible]	-.081	[illegible]	-.080	[illegible]	.646	[illegible]	.580	.341	.478	[illegible]	-.713	.346	1.000											
25 Right Grip Strength	[illegible]	[illegible]	[illegible]	[illegible]	.440	[illegible]	[illegible]	[illegible]	.373	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.320	.318	[illegible]	.253	[illegible]	-.278	[illegible]	.164	1.000										
26 Left Grip Strength	[illegible]	[illegible]	[illegible]	[illegible]	.455	.373	[illegible]	.068	[illegible]	[illegible]	[illegible]	.081	.066	.114	.486	[illegible]	.375	[illegible]	.198	[illegible]	.419	-.147	-.314	.200	[illegible]	1.000									
27 Sit-Reach	[illegible]	[illegible]	.480	.700	.614	.675	[illegible]	[illegible]	.264	.290	.166	-.037	-.117	-.170	.139	.214	.081	.094	.127	.191	.271	-.199	.368	-.047	.048	-.011	1.000								
28 Cardis-Vascular Count	.048	-.127	-.206	-.055	.233	-.017	-.163	-.236	-.283	-.302	-.343	.701	.777	.639	-.081	[illegible]	-.272	-.385	-.447	[illegible]	-.343	.071	.257	-.185	.119	.256	.133	1.000							
29 Sum of Fat Measurements	-.247	-.335	-.366	-.192	-.021	-.254	.049	-.128	-.122	.011	-.145	.994	.989	.989	.291	.168	.204	-.076	.005	.064	-.006	.227	-.037	-.080	-.034	.089	-.104	.713	1.000						
30 Difference-Inspiration-Expiration	.213	.078	-.016	.069	.162	.112	-.360	-.060	-.177	-.567	-.230	-.204	-.072	-.288	-.763	-.512	-.848	-.475	-.790	-.136	-.566	-.228	.591	.067	-.194	-.204	.095	.337	-.189	1.000					
31 Standard Height	.051	.147	.341	.365	.444	.278	-.004	.303	.321	.378	.119	.124	.061	.115	.461	.452	.325	.453	.191	.990	.210	-.165	-.102	.504	.310	.381	.169	.162	.105	-.086	1.000				
32 Sum of Right-Lift Grip	.348	.393	.424	.270	.453	.416	.421	.050	.386	.443	.208	.014	-.006	.031	.418	.389	.347	.314	.219	.292	.409	-.231	-.285	.180	.990	.976	.025	.224	.014	-.201	.343	1.000			
33 Leg Length	.633	.757	.726	.776	.728	.765	.370	.685	[illegible]	.840	.633	-.055	-.152	-.055	.555	.758	.526	.788	.537	.401	[illegible]	-.372	-.095	.633	.438	.458	.293	[illegible]	-.086	-.110	.415	.452	1.000		
34 Relative Height	.571	.698	.470	[illegible]	.463	[illegible]	.337	[illegible]	[illegible]	[illegible]	[illegible]	-.166	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.285	[illegible]	[illegible]	-.356	[illegible]	-.157	[illegible]	[illegible]	[illegible]	1.000	
35 Ponderal Index	[illegible]	[illegible]	-.054	[illegible]	[illegible]	.001	[illegible]	-.172	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.336	[illegible]	[illegible]	[illegible]	[illegible]	-.176	[illegible]	[illegible]	[illegible]	[illegible]	.826	[illegible]	-.215	[illegible]	.158	1.000

TABLE 4.3--Correlation Matrix for Boys, Age Group 3.

Illustration 4.6. Cluster Analysis on Boys, Age Group 3.

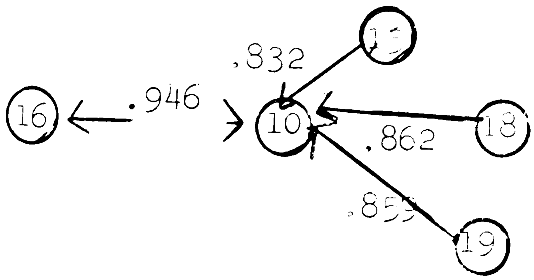
First Cluster of Variables



Number and Name of Variable

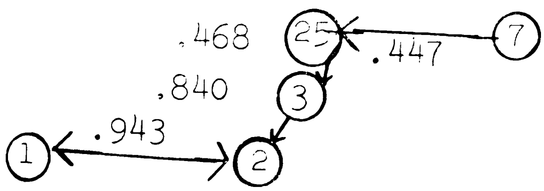
12 Triceps Skinfold
14 Abdominal Skinfold
13 Subscapular Skinfold
28 Pulse Recovery Rate

Second Cluster of Variables



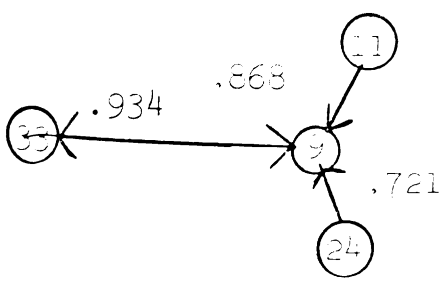
16 Chest Inspiration
10 Weight
15 Upper Arm Circumference
18 Biacromial Diameter
19 Bicristal Diameter

Third Cluster of Variables



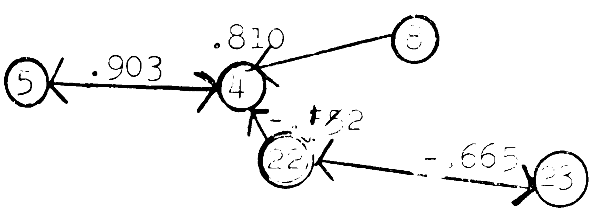
1 Academic Vocabulary
2 Reading Comprehension
3 Language
25 Right Grip Strength
7 Social Approachability

Fourth Cluster of Variables



33 Leg Length
9 Height
11 Sitting Height
24 Softball Throw

Fifth Cluster of Variables



5 Arithmetic
4 Work Study
8 Emotional Stability
22 40 Yard Dash

is indicative of total body coordination, grouped with body size; and that social behavior again related to body type. The fourth cluster showed a specificity of motor performance--strength and high pulse count (or low recovery rate).

Observing correlation coefficients in Table 4.3 (boys, age group three), the range in value was between .994 and -.848. The highest positive correlation was between variables #12 (triceps skinfold) and #29 (sum of fat measurements). The highest positive correlation between an academic and a variable in another area was .810, variables #4 (work study) and #8 (emotional stability). The highest negative correlation was between variables #17 (chest expiration) and #30 (difference between inspiration and expiration). Significance at the .05 level was .532 for this age group.

The cluster analysis on boys, age group three (Illustration 4.6), showed a clustering of the variables: anthropometric-motor, anthropometric, academic-motor-social, and anthropometric-motor. As would be expected fatness and recovery rate clustered and body density and structure clustered. A different clustering was noted in this age group; namely, academic achievement with strength and with social behavior. The grouping of linear measurements and coordination (softball throw) was again noted. In the fifth cluster a negative correlation was noted between standing broad jump and the 40-yard dash.

Variable	1 Academic Vocabulary	2 Reading Comprehension	3 Total Language	4 Total Work Study	5 Total Arithmetic	6 Academic Composite	7 Social Rating	8 Emotional Scale	9 Actual Height	10 Actual Weight	11 Sitting Height	12 Triceps Skinfold
1	[illegible]	.917	.866	.911	.852	.955	-.025	.065	.777	.764	.654	.582
2		1.000	[illegible]	[illegible]	.874	.969	-.002	.219	.776	.650	.716	.415
3			1.000	[illegible]	.852	.948	.140	.180	.733	.674	.652	.366
4				1.000	.901	.974	.044	.060	.825	[illegible]	.674	.485
5					1.000	.930	-.166	.058	.758	[illegible]	.536	[illegible]
6						1.000	-.003	.122	[illegible]	[illegible]	.686	.456
7							1.000	.185	-.133	.079	[illegible]	.177
8								1.000	.132	.175	[illegible]	.025
9									1.000	.775	.808	[illegible]
10										1.000	[illegible]	.764
11											1.000	.359
12												1.000

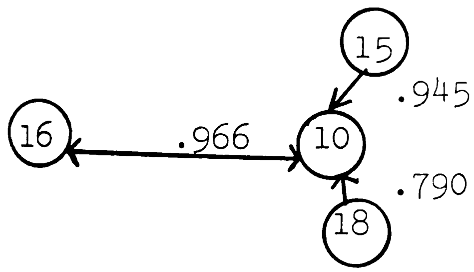
Variable	13 Subscapular Skinfold	14 Abdominal Skinfold	15 Upper Arm Circumference	16 Chest Inspiration	17 Chest Expiration	18 Biacromial Diameter	19 Bicristal Diameter	20 Standard Weight	21 Relative Weight	22 40-Yard Dash	23 Standing Broad Jump	24 Softball Throw
1	.574	.531	.638	.701	.670	.634	.413	.551	.648	-.090	.166	.496
2	.438	.476	.544	.539	.546	.574	.364	.604	.547	-.209	.276	.503
3	.447	[illegible]	.557	[illegible]	.557	.653	.376	.572	.464	-.269	.405	.623
4	[illegible]	.423	.583	.556	.540	[illegible]	.333	.515	.486	-.288	.391	.573
5	.375	.367	.515	.535	.581	[illegible]	.332	.581	.384	-.307	.491	.563
6	.478	.477	.637	[illegible]	.591	[illegible]	.377	.613	.545	-.237	.350	.571
7	.291	.107	.156	.075	.131	-.068	.217	-.330	.140	.128	-.057	-.053
8	.179	.097	.174	.229	.218	[illegible]	-.016	-.049	.227	.138	-.158	-.132
9	.422	[illegible]	.601	.721	.687	.700	.426	.633	.644	-.224	.298	.426
10	[illegible]	[illegible]	.945	.906	[illegible]	.700	.673	[illegible]	[illegible]	.220	-.144	.256
11	.371	[illegible]	.954	.660	[illegible]	[illegible]	[illegible]	[illegible]	.636	-.039	.073	.241
12	[illegible]	.847	[illegible]	.724	.745	[illegible]	.715	[illegible]	.759	.349	-.262	.061
13	1.000	[illegible]	[illegible]	[illegible]	.871	[illegible]	[illegible]	.255	.753	.484	-.296	.096
14		1.000	[illegible]	.809	[illegible]	[illegible]	[illegible]	.306	.843	.410	-.319	.092
15			1.000	[illegible]	[illegible]	[illegible]	[illegible]	.448	.874	.274	-.151	.223
16				1.000	.971	[illegible]	[illegible]	.353	.923	.246	-.158	.208
17					1.000	[illegible]	.686	[illegible]	[illegible]	.231	-.131	.249
18						1.000	.648	.362	.748	-.105	.124	.420
19							1.000	.102	.695	.105	-.067	.167
20								1.000	.114	-.232	.418	.501
21									1.000	.306	-.291	.115
22										1.000	-.794	-.623
23											1.000	.582
24												1.000

Variable	25 Right Grip Strength	26 Left Grip Strength	27 Sit-Reach	28 Cardio-Vascular Count	29 Sum of Fat Measurements	30 Difference-Inspiration-Expiration	31 Standard Height	32 Sum of Right-Left Grip	33 Leg Length	34 Relative Height	35 Ponderal Index
1	.729	.713	.192	-.075	.603	.081	.576	.737	.646	.483	-.348
2	.713	.672	.235	-.069	.445	.138	.510	.707	.595	.538	-.175
3	.777	.773	.228	-.026	.442	.010	.592	.792	.639	.484	-.153
4	.799	.737	.282	-.115	.436	.030	.644	.779	.703	.465	-.128
5	.726	.631	.341	.018	.389	.191	[illegible]	.687	.718	.352	-.074
6	.777	.725	.258	-.066	.492	.086	[illegible]	.772	.689	.499	-.192
7	-.180	.009	-.051	.305	.190	-.238	-.302	-.088	-.227	.096	-.285
8	-.061	-.071	-.087	.267	.109	.032	-.077	-.070	-.080	.236	-.110
9	.801	.702	.049	-.207	.476	.091	.651	.767	.860	.716	-.210
10	.589	.607	-.060	-.103	.862	-.012	.436	.611	.609	[illegible]	[illegible]
11	.612	.578	-.144	-.066	.395	.199	.426	.607	.395	.679	-.271
12	.272	.318	-.030	.026	[illegible]	-.136	.224	.301	.328	[illegible]	-.771
13	.239	.315	-.003	-.012	.971	-.232	.297	.287	.329	.267	[illegible]
14	.364	.418	-.050	-.130	.977	-.194	.302	.399	.456	.332	[illegible]
15	.527	[illegible]	-.016	-.008	.896	-.141	.479	[illegible]	.552	.413	-.815
16	.502	[illegible]	-.100	.007	.845	.048	.337	[illegible]	.570	[illegible]	-.779
17	.476	.466	-.140	-.034	.878	-.191	.425	.491	.568	[illegible]	-.795
18	.626	.557	-.135	-.163	.559	.031	.381	.604	[illegible]	.646	-.462
19	.155	.135	-.255	.062	.673	-.187	.074	.148	.314	.477	-.624
20	.687	.577	.063	-.228	.289	-.207	.985	.645	.656	-.074	-.029
21	.422	.477	-.090	-.045	.832	.067	.146	.459	.454	.639	-.820
22	-.388	-.221	.155	.199	.435	.042	-.189	-.311	-.316	-.126	-.579
23	.401	.324	.156	.054	-.308	-.100	.399	.370	.402	.027	.526
24	[illegible]	.562	.057	-.301	.089	-.185	.494	.625	.456	.102	.063
25	1.000	.919	.109	-.316	.313	.073	.709	.980	.721	.403	-.092
26		1.000	.242	-.150	.377	.049	.613	.979	.534	.353	-.215
27			1.000	.180	-.031	.220	.148	.179	.201	-.083	.169
28				1.000	-.054	.174	-.229	-.238	-.266	-.082	-.041
29					1.000	-.199	.291	.353	.400	.345	-.867
30						1.000	-.147	.062	.031	.257	.123
31							1.000	.679	.647	-.063	-.046
32								1.000	.671	.386	-.157
33									1.000	.537	-.092
34										1.000	-.215
35											1.000

TABLE 4.4--Correlation Matrix for Boys, Age Group 4.

Illustration 4.7. Cluster Analysis on Boys, Age Group 4.

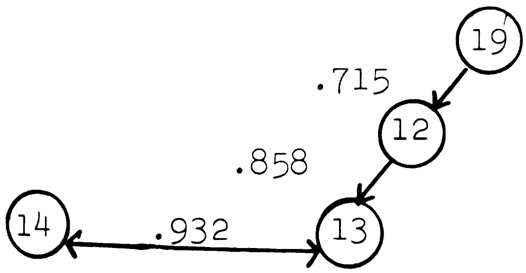
First Cluster of Variables



Number and Name of Variable

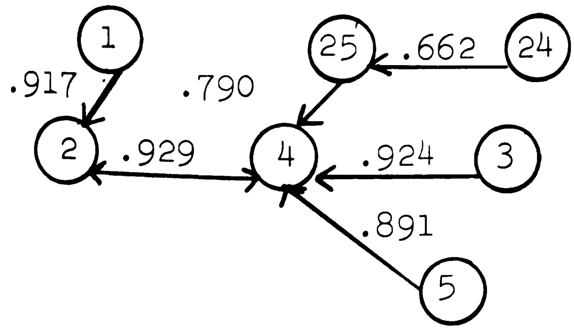
16 Chest Inspiration
10 Weight
15 Upper Arm Circumference
18 Biacromial Diameter

Second Cluster of Variables



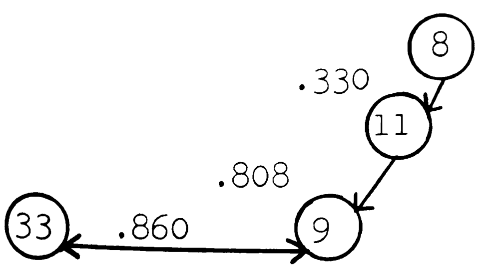
14 Abdominal Skinfold
13 Subscapular Skinfold
12 Triceps Skinfold
19 Bicristal Diameter

Third Cluster of Variables



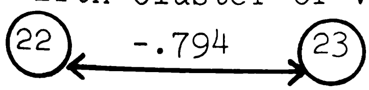
2 Reading Comprehension
4 Work Study
1 Academic Vocabulary
3 Language
5 Arithmetic
25 Right Grip Strength
24 Softball Throw

Fourth Cluster of Variables



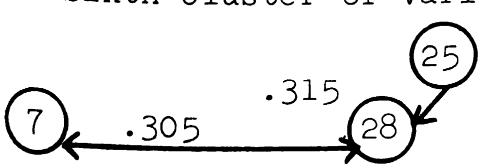
33 Leg Length
9 Height
11 Sitting Height
8 Emotional Stability

Fifth Cluster of Variables



22 40-Yard Dash
23 Standing Broad Jump

Sixth Cluster of Variables



7 Social Approachability
28 Pulse Recovery Rate
25 Right Grip Strength

Observing correlation coefficients in Table 4.4 (boys, age group four), the range in value was between .977 and -.867. The highest positive correlation was between variables #14 (abdominal skinfold) and #29 (sum of fat measurements). The highest positive correlation between an academic and variable in another area was .825, variables #4 (work study) and #9 (actual height). The highest negative correlation was between variables #29 (sum of fat measurements) and #35 (ponderal index). Significiance at the .05 level was .374 for this age group.

The cluster analysis on boys, age group four (Illustration 4.7), showed a clustering of the variables: anthropometric, academic-motor, anthropometric-social, motor and socio-motor. Clusters one and two showed body density and body structure grouping together. In the third cluster academic variables grouped with strength and coordinative variables, while linearity and emotional stability grouped together--the fourth cluster (there are supporting statements in literature regarding self-concepts adjustment and body build). The fifth cluster showed, again, the relationship of strength to recovery rate. There was also a relationship to social behavior.

Observing correlation coefficients in Table 4.5 (boys, age group five), the range in value was between .957 and -.819. The highest positive correlation was between

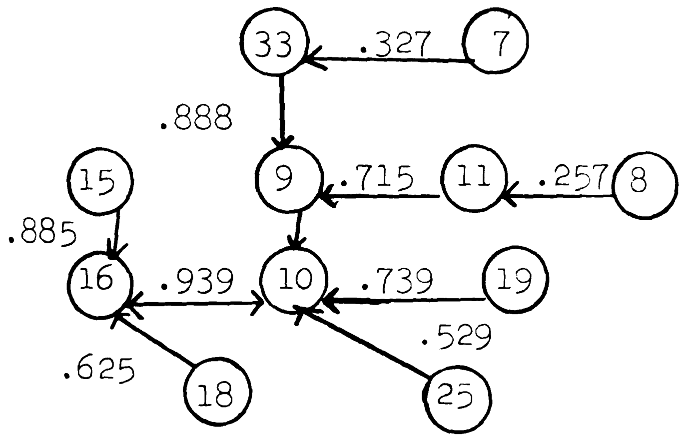
TABLE 4.5--Correlation Matrix for Boys, Age Group 4.

[illegible] 1	[illegible] 2	[illegible] 3	[illegible] 4	Total Arithmetic 5	Academic Composite 6	[illegible] Rating 7	Emotional Scale 8	Actual Height 9	Actual Weight 10	Sitting Height 11	Triceps Skinfold 12	Subscapular Skinfold 13	Abdominal Skinfold 14	Upper Arm Circumference 15	Chest Inspiration 16	Chest Expiration 17	Biacromial Diameter 18	Bicristal Diameter 19	Standard Weight 20
1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
						1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
									1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
											1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
												1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
													1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
														1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
															1.000	[illegible]	[illegible]	[illegible]	[illegible]
																1.000	[illegible]	[illegible]	[illegible]
																	1.000	[illegible]	[illegible]
																		1.000	[illegible]
																			1.000

Relative Weight 21	40-Yard Dash 22	Standing Broad Jump 23	Softball Throw 24	Right Grip Strength 25	Left Grip Strength 26	Sit-Reach 27	Cardio-Vascular Count 28	Sum of Fat Measurement 29	Difference-Inspiration-Expiration 30	Standard Height 31	Sum of Right-Left Grip 32	Leg Length 33	Relative Height 34	Ponderal Index 35
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.148	[illegible]	.041	[illegible]	[illegible]	.173	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.179	[illegible]	-.084	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	-.041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.144	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	-.090	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.118	[illegible]	-.013	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.148	-.027	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.047	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.041	[illegible]	[illegible]	[illegible]	.078	[illegible]	[illegible]	[illegible]	[illegible]	.417	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.411	[illegible]	[illegible]	[illegible]	-.131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	-.068	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	-.188	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.161	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.217	[illegible]	.113	[illegible]	[illegible]	-.183	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-.345	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.471	[illegible]	[illegible]	.251	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.081	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.088	[illegible]	[illegible]	.188	.184	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.006	-.066	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.000	[illegible]	[illegible]	[illegible]	.530	[illegible]	.134	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1.000	[illegible]	[illegible]	-.127	-.130	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		1.000	[illegible]	.114	.033	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.078	[illegible]	[illegible]
			1.000	.307	[illegible]	-.041	-.281	[illegible]	.111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					1.000	.083	-.218	.167	[illegible]	[illegible]	[illegible]	.311	[illegible]	[illegible]
						1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								1.000	-.144	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
									1.000	.014	[illegible]	[illegible]	[illegible]	[illegible]
										1.000	-.008	.314	-.088	[illegible]
											1.000	.308	[illegible]	[illegible]
												1.000	[illegible]	[illegible]
													1.000	-.147
														1.000

Illustration 4.8. Cluster Analysis on Boys, Age Group 5.

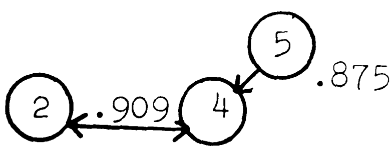
First Cluster of Variables



Number and Name of Variable

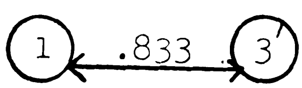
16 Chest Inspiration
10 Weight
15 Upper Arm Circumference
18 Biacromial Diameter
9 Height
33 Leg Length
25 Right Grip Strength
19 Bicristal Diameter
7 Social Approachability
11 Sitting Height
8 Emotional

Second Cluster of Variables



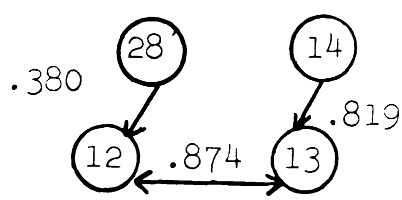
2 Reading Comprehension
4 Work Study
5 Arithmetic

Third Cluster of Variables



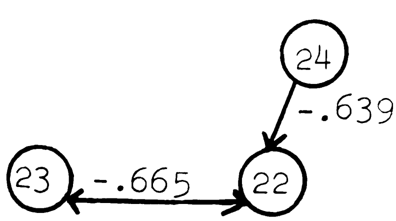
1 Academic Vocabulary
3 Language

Fourth Cluster of Variables



12 Triceps Skinfold
13 Subscapular Skinfold
28 Pulse Recovery Rate
14 Abdominal Skinfold

Fifth Cluster of Variables



23 Standing Broad Jump
22 40-Yard Dash
24 Softball Throw

variables #25 (right grip strength) and #32 (sum of grip strength). The highest positive correlation between an academic and a variable in another area was .460, variables #5 (arithmetic) and #24 (softball throw). The highest negative correlation was between variables #15 (upper arm circumference) and #35 (ponderal index). Significance at the .05 level was .254 for this age group.

The cluster analysis on boys, age group five (Illustration 4.8), showes a clustering of the variables: anthropometric-motor-social, academic, anthropometric-motor, and motor.

Cluster one showed a clustering of all areas of variables except the academic--body structure and density clustered with strength and social-emotional behavior. Academic clusters were easily viewed from the illustration. Again there was a clustering of fat measurements and slow recovery rate, which was documented in other experiments. The fifth cluster showed specificity of motor performance variables, especially with negative correlations.

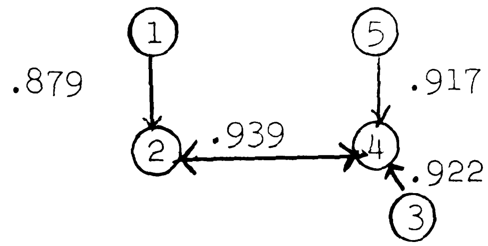
Observing correlation coefficients in Table 4.6 (boys, age group six), the range in value was between .976 and -.705. The highest positive correlation was between variables #4 (work study) and #6 (academic composite). The highest positive correlation between an academic and an unrelated variable was .500, variables #5 (arithmetic) and #33 (leg length). The highest negative correlation was between variables #13 (subscapular skinfold) and #35 (ponderal index). Significance at the .05 level was .280 for this age group.

TABLE 4.6--Correlation Matrix for Boys, Age Group 6.

Variable	Correlations with variables 1, 2, 3, … (down the printed column, ending on the diagonal)
1 Academic Vocabulary	1.000
2 Reading Comprehension	[illegible] 1.000
3 Total Language	[illegible] 1.000
4 Total Work Study	[illegible] 1.000
5 Total Arithmetic	[illegible] 1.000
6 Academic Composite	[illegible] 1.000
7 Social Rating	[illegible] 1.000
8 Emotional Scale	[illegible] 1.000
9 Actual Height	[illegible] 1.000
10 Actual Weight	[illegible] 1.000
11 Sitting Height	[illegible] 1.000
12 Triceps Skinfold	[illegible] 1.000
13 Subscapular Skinfold	[illegible] 1.000
14 Abdominal Skinfold	[illegible] 1.000
15 Upper Arm Circumference	[illegible] 1.000
16 Chest Inspiration	[illegible] 1.000
17 Chest Expiration	[illegible] 1.000
18 Biacromial Diameter	[illegible] 1.000
19 Bicristal Diameter	[illegible] 1.000
20 Standard Weight	[illegible] 1.000
21 Relative Weight	[illegible] 1.000
22 40-Yard Dash	[illegible] 1.000
23 Standing Broad Jump	[illegible] 1.000
24 Softball Throw	[illegible] 1.000
25 Right Grip Strength	[illegible] 1.000
26 Left Grip Strength	[illegible] 1.000
27 Sit-Reach	[illegible] 1.000
28 Cardio-Vascular Count	[illegible] 1.000
29 Sum of Fat Measurements	[illegible] 1.000
30 Difference-Inspiration-Expiration	.020 .046 .062 .063 .058 .049 .016 -.109 -.019 -.115 -.030 -.074 -.161 -.068 -.204 .271 .142 .053 -.085 -.162 -.042 -.037 -.264 -.132 -.044 -.061 .156 .138 -.137 1.000
31 Standard Height	.203 .231 .228 .271 .370 .271 -.076 -.073 [illegible] [illegible] [illegible] .206 .307 .237 .342 .047 .065 .080 .348 .307 .107 .092 .042 .400 .170 .113 .094 -.006 .303 -.122 1.000
32 Sum of Right-Left Grip	.130 .068 .101 .116 .119 .110 -.274 -.040 .436 .447 .357 .264 .194 .210 .467 .159 .172 .117 .234 .227 .400 .076 .164 .478 .273 .266 -.062 .241 .247 -.056 .148 1.000
33 Leg Length	.463 .476 .447 .473 .500 .481 -.504 -.077 .884 .608 .374 .340 [illegible] .244 .313 .206 .212 .244 .230 .286 .583 -.059 .032 .334 .377 .341 .013 .088 .315 -.005 .258 .372 1.000
34 Relative Height	.217 .277 .357 .321 .344 .340 -.130 -.034 .414 .605 .652 .275 .280 .156 .434 .417 .426 .414 .574 .000 .723 -.043 .024 .275 .376 .341 -.015 .068 .243 .025 -.053 .395 .532 1.000
35 Ponderal Index	[illegible] [illegible] [illegible] .187 .116 .053 .189 .047 .182 -.220 -.185 -.667 -.705 -.387 -.667 -.431 -.463 -.060 -.437 -.178 -.614 .028 -.018 -.186 -.207 -.106 .018 -.081 -.602 .146 -.148 -.165 .140 .067 1.000

Illustration 4.9. Cluster Analysis on Boys, Age Group 6.

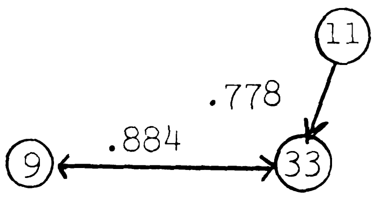
First Cluster of Variables



Number and Name of Variable

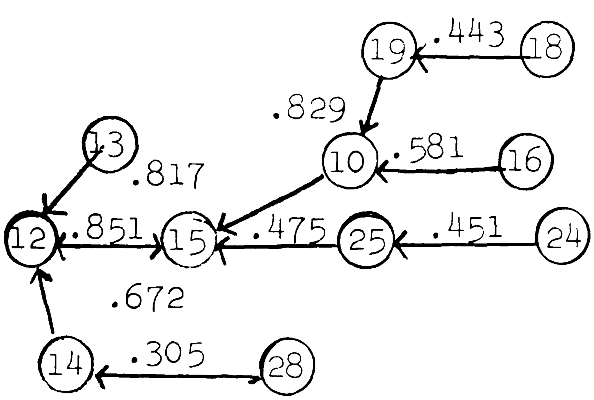
2 Reading Comprehension
4 Work Study
1 Academic Vocabulary
5 Arithmetic
3 Language

Second Cluster of Variables



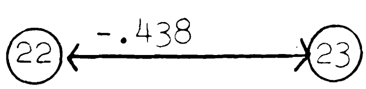
9 Height
33 Leg Length
11 Sitting Height

Third Cluster of Variables



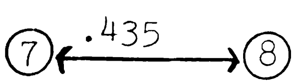
12 Triceps Skinfold
15 Upper Arm Circumference
13 Subscapular Skinfold
14 Abdominal Skinfold
25 Right Grip Strength
10 Weight
19 Bicristal Diameter
28 Pulse Recovery Rate
18 Biacromial Diameter
16 Chest Inspiration
24 Softball Throw

Fourth Cluster of Variables



22 40-Yard Dash
23 Standing Broad Jump

Fifth Cluster of Variables



7 Social Approachability
8 Emotional Stability

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1 Academic Vocabulary	1.000	[illegible]	.872	[illegible]	.785	[illegible]	.043	.218	.170	.253	-.084	.239
2 Reading Comprehension		1.000	[illegible]	[illegible]	[illegible]	[illegible]	.177	.234	-.319	.037	-.168	.048
3 Total Language			1.000	[illegible]	[illegible]	[illegible]	.096	.244	-.075	.287	-.228	.270
4 Total Work Study				1.000	[illegible]	[illegible]	.180	.234	.212	.285	-.078	.325
5 Total Arithmetic					1.000	[illegible]	.347	[illegible]	[illegible]	.140	-.174	.232
6 Academic Composite						1.000	.164	.233	[illegible]	.170	-.155	.234
7 Social Rating							1.000	.175	.253	.209	.077	.126
8 Emotional Scale								1.000	.247	.274	.157	-.035
9 Actual Height									1.000	.646	.826	-.094
10 Actual Weight										1.000	.635	.454
11 Sitting Height											1.000	-.138
12 Triceps Skinfold												1.000

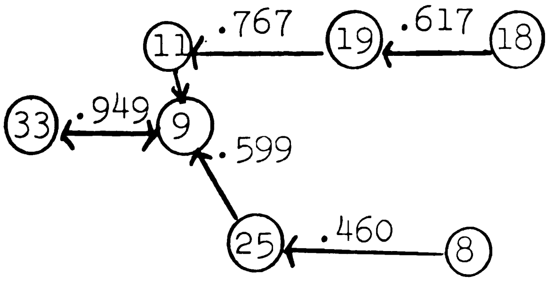
Variable	13	14	15	16	17	18	19	20	21	22	23	24
1 Academic Vocabulary	.313	.232	.066	.313	.308	.026	-.083	.066	.237	.039	.156	.060
2 Reading Comprehension	.065	.224	-.249	.132	.114	-.081	-.258	-.043	.053	-.168	.256	.087
3 Total Language	.214	.178	-.149	.139	.133	-.101	-.297	.071	.071	-.201	.263	-.091
4 Total Work Study	.287	.267	.047	.301	.287	.064	-.127	.137	.244	-.212	.176	-.010
5 Total Arithmetic	.200	.173	-.080	.206	.187	-.023	-.214	.088	.127	-.298	.275	-.012
6 Academic Composite	.227	.190	-.048	.243	.216	-.028	-.208	.064	.156	-.175	.222	-.027
7 Social Rating	.091	.139	.042	.064	.254	.381	.171	-.012	.166	-.396	.176	.112
8 Emotional Scale	.128	.173	.064	.286	.147	.122	.200	-.131	.243	-.152	.259	.223
9 Actual Height	.113	.151	.389	.487	.553	.583	.657	.100	.595	-.104	-.202	.252
10 Actual Weight	.627	.736	.752	.552	.550	.604	.724	.061	.553	.150	-.013	.267
11 Sitting Height	.144	.174	.585	.578	.549	.502	.767	.079	.514	.055	-.296	.367
12 Triceps Skinfold	.863	.831	.717	.316	.451	-.096	.132	.078	.462	.228	-.039	-.303
13 Subscapular Skinfold	1.000	.845	.749	.509	.656	-.003	.380	.005	.655	.327	.055	-.110
14 Abdominal Skinfold		1.000	.862	.542	.722	.259	.355	.120	.581	.234	.036	-.133
15 Upper Arm Circumference			1.000	.547	.705	.465	.541	.018	.721	.260	-.030	-.024
16 Chest Inspiration				1.000	.871	.478	.726	-.130	.859	.147	.199	.437
17 Chest Expiration					1.000	.543	.774	.035	.921	.184	.158	.358
18 Biacromial Diameter						1.000	.617	.097	.547	-.019	.150	.309
19 Bicristal Diameter							1.000	-.078	.735	.254	-.066	.304
20 Standard Weight								1.000	-.238	.036	-.139	-.176
21 Relative Weight									1.000	.158	.012	.304
22 40-Yard Dash										1.000	-.319	-.328
23 Standing Broad Jump											1.000	.451
24 Softball Throw												1.000

Variable	25	26	27	28	29	30	31	32	33	34	35
1 Academic Vocabulary	.351	.146	.018	.400	.269	-.007	.024	.265	.287	-.154	-.066
2 Reading Comprehension	.041	-.065	-.120	.396	.044	.146	-.068	-.012	.067	.000	-.067
3 Total Language	.222	-.030	-.108	.428	.235	.005	.043	.105	.027	-.086	-.202
4 Total Work Study	.294	.063	-.030	.512	.302	.013	.089	.191	.343	.177	-.075
5 Total Arithmetic	.114	-.077	-.048	.486	.206	.026	.064	.022	.176	.037	-.106
6 Academic Composite	.215	.002	-.055	.474	.225	.041	.029	.117	.184	.056	-.114
7 Social Rating	.023	.166	-.091	.095	.101	-.383	-.050	.098	.230	.196	.003
8 Emotional Scale	.460	.515	-.672	.116	.083	.263	-.119	.515	.330	.316	.098
9 Actual Height	.577	.453	.080	-.091	.077	-.157	.057	.578	.949	.946	.501
10 Actual Weight	.547	.477	-.005	.314	.679	-.239	.041	.551	.556	.549	-.332
11 Sitting Height	.462	.300	.114	-.202	.058	-.183	.078	.435	.605	.771	.301
12 Triceps Skinfold	.073	.016	-.011	.559	.936	-.344	.093	.-59	-.042	-.113	-.650
13 Subscapular Skinfold	.262	.254	-.070	.472	.941	-.321	.023	.273	.079	.095	-.586
14 Abdominal Skinfold	.286	.256	-.079	.606	.960	-.345	.121	.287	.143	.095	-.636
15 Upper Arm Circumference	.338	.289	.075	.424	.814	-.343	-.040	.332	.304	.328	-.458
16 Chest Inspiration	.422	.400	-.226	.351	.495	.205	-.142	.471	.424	.502	-.371
17 Chest Expiration	.471	.523	-.058	.287	.662	-.302	.016	.525	.473	.519	-.384
18 Biacromial Diameter	.473	.433	.104	.136	.074	-.253	.037	.452	.542	.546	.017
19 Bicristal Diameter	.378	.475	-.025	.003	.317	-.134	-.076	.460	.499	.651	-.097
20 Standard Weight	.155	-.004	.466	-.173	.-79	-.321	.989	.082	.097	-.222	-.069
21 Relative Weight	.486	.466	-.128	.367	.645	-.148	-.257	.504	.507	-.646	-.348
22 40-Yard Dash	-.077	-.078	.266	.047	.271	-.080	.095	-.082	-.161	-.133	-.284
23 Standing Broad Jump	.102	.421	-.579	.103	.019	.071	-.167	.273	-.170	-.143	-.248
24 Softball Throw	.158	.375	-.332	-.157	-.184	.135	-.186	.290	.150	.297	.024
25 Right Grip Strength	1.000	.788	-.242	.016	.237	-.159	.127	.948	.586	.532	.123
26 Left Grip Strength		1.000	-.519	-.080	.197	-.091	-.041	.943	.494	.479	.059
27 Sit-Reach			1.000	-.146	-.059	-.324	.446	-.400	.048	-.060	.121
28 Cardio-Vascular Count				1.000	.584	.119	-.164	-.033	-.016	-.041	-.482
29 Sum of Fat Measurements					1.000	-.358	.089	.230	.076	.038	-.663
30 Difference-Inspiration-Expiration						1.000	-.307	-.133	-.120	-.060	-.045
31 Standard Height							1.000	.047	.037	-.267	.042
32 Sum of Right-Lift Grip								1.000	.572	.535	.097
33 Leg Length									1.000	.904	.538
34 Relative Height										1.000	.481
35 Pondered Index											1.000

TABLE 4.7--Correlation Matrix for Boys, Age Group 7.

Illustration 4.10. Cluster Analysis on Boys, Age Group 7.

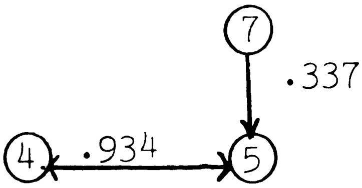
First Cluster of Variables



Number and Name of Variable

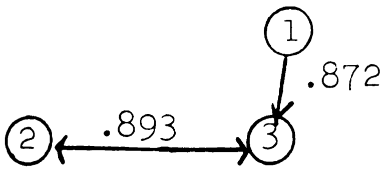
33 Leg Length
9 Height
11 Sitting Height
25 Right Grip Strength
8 Emotional Stability
19 Bicristal Diameter
18 Biacromial Diameter

Second Cluster of Variables



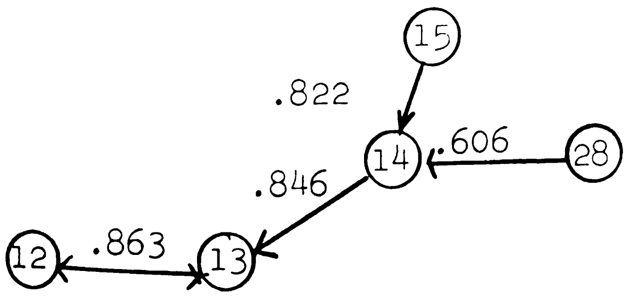
4 Work Study
5 Arithmetic
7 Social Approachability

Third Cluster of Variables



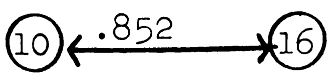
2 Reading Comprehension
3 Language
1 Academic Vocabulary

Fourth Cluster of Variables



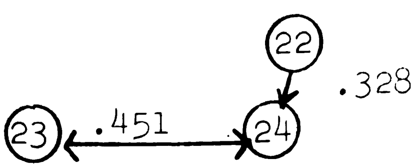
12 Triceps Skinfold
13 Subscapular Skinfold
14 Abdominal Skinfold
15 Upper Arm Circumference
28 Pulse Recovery Rate

Fifth Cluster of Variables



10 Weight
16 Chest Inspiration

Sixth Cluster of Variables



23 Standing Broad Jump
24 Softball Throw
22 40 Yard Dash

The cluster analysis on boys, age group six (Illustration 4.9), showed a clustering of the variables; academic, anthropometric, anthropometric-motor, motor and social. Clusters one and two should anticipate clusterings--academic with academic and linear measurements among themselves. The third cluster, however, showed a clustering of body size (bone and density measurements) with strength, slow recovery and coordination (the heavy youngster at this age would be strong, coordinated and have a slow pulse recovery rate following exercise). This is the first indication of clustering within the social-emotional behavior area.

Observing correlation coefficients in Table 4.7 (boys, age group seven), the range in value was between .958 and -.663. The highest positive correlation was between variables #3 (language) and #6 (academic composite). The highest positive correlation between an academic and a variable in another area was .512, variables #4 (work study) and #28 (cardio-vascular pulse count). The highest negative correlation was between variables #29 (sum of fat measurements) and #35 (ponderal index). Significance at the .05 level was .388 for this age group.

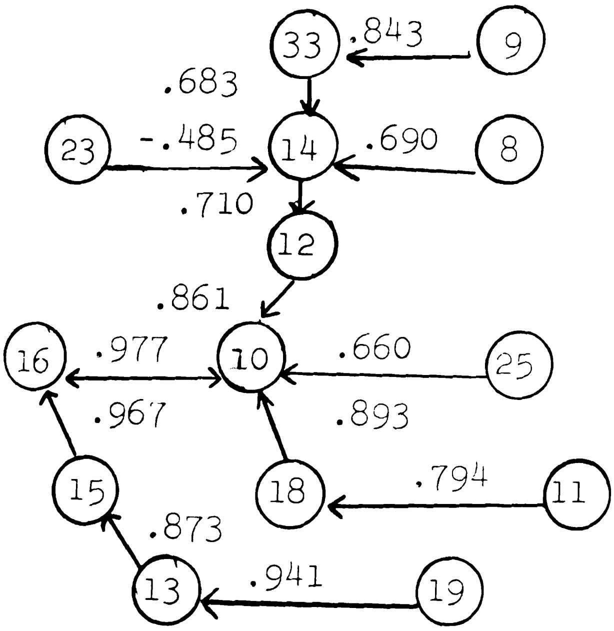
The cluster analysis on boys, age group seven (Illustration 4.10), showed a clustering of the variables: anthropometric-motor-social, academic-social, academic, anthropometric-motor, anthropometric and motor. In cluster

1 Academic [illegible]	2 Reading Comprehension	3 Total Language	4 Total Work Study	5 Total Arithmetic	6 Academic Composite	7 Social Rating	8 Emotional Scale	9 Actual Height	10 Actual Weight	11 Sitting Height	12 Triceps Skinfold	13 Subscapular Skinfold	14 Abdominal Skinfold	15 Upper Arm Circumference	16 Chest Inspiration	17 Chest Expiration	18 Biacromial Diameter	19 Bicristal Diameter	20 Standard Weight	21 Relative Weight	22 40-Yard Dash	23 Standing Broad Jump	24 Softball Throw	25 Right Grip Strength	26 Left Grip Strength	27 Sit-Reach	28 Cardio-Vascular Count	29 Sum of Fat Measurements	30 Difference-Inspiration-Expiration	31 Standard Height	32 Sum of Right-Left Grip	33 Leg Length	34 Relative Height	35 Ponderal Index
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.347	[illegible]	[illegible]	-.413	[illegible]	-.236	-.390	[illegible]	[illegible]	-.258	-.112	-.324	.076	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.414	[illegible]	-.168	[illegible]	[illegible]	-.238	[illegible]
	1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.364	[illegible]	[illegible]	-.436	-.384	[illegible]	-.341	-.419	[illegible]	.313	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.210	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.314
		1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.337	[illegible]	-.181	[illegible]	[illegible]	[illegible]	-.269	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.371	[illegible]	[illegible]	[illegible]	[illegible]
			1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.348	-.313	-.344	[illegible]	-.310	-.346	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.346	-.474	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.288	-.281	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.131	[illegible]	[illegible]	[illegible]	[illegible]	.173	[illegible]	[illegible]	[illegible]
					1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.461	[illegible]	[illegible]	-.313	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.147	[illegible]	[illegible]	[illegible]
						1.000	[illegible]	[illegible]	[illegible]	-.175	.136	.336	.437	[illegible]	.156	.282	-.033	.318	-.410	.126	.476	[illegible]	[illegible]	[illegible]	-.073	[illegible]	[illegible]	.366	[illegible]	-.474	-.081	[illegible]	[illegible]	[illegible]
							1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.684	[illegible]	[illegible]	[illegible]	[illegible]	-.160	[illegible]	.173	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								1.000	[illegible]	[illegible]	.732	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.738	[illegible]	-.440	[illegible]	[illegible]	[illegible]	[illegible]	.448	[illegible]	[illegible]	.371	[illegible]	[illegible]	-.413	.431	[illegible]	[illegible]	[illegible]
									1.000	[illegible]	.861	[illegible]	.474	.740	[illegible]	[illegible]	[illegible]	[illegible]	-.434	[illegible]	-.168	.137	[illegible]	[illegible]	[illegible]	[illegible]	.111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										1.000	.617	[illegible]	.124	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.367	[illegible]	[illegible]	[illegible]	[illegible]	.174	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
											1.000	[illegible]	.720	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.033	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.463	[illegible]	[illegible]	[illegible]
												1.000	[illegible]	.873	.843	.874	[illegible]	.941	[illegible]	[illegible]	.044	[illegible]	[illegible]	.313	[illegible]	.173	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
													1.000	.500	.439	.508	[illegible]	[illegible]	[illegible]	[illegible]	.304	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.476	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
														1.000	.967	.987	[illegible]	[illegible]	-.475	[illegible]	-.041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
															1.000	[illegible]	[illegible]	[illegible]	-.373	[illegible]	[illegible]	.128	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.718	[illegible]	-.371	[illegible]	[illegible]	[illegible]	[illegible]
																1.000	[illegible]	.895	-.434	[illegible]	.014	[illegible]	[illegible]	[illegible]	[illegible]	.017	.124	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																	1.000	-.780	-.317	[illegible]	-.078	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																		1.000	-.430	[illegible]	[illegible]	-.041	.315	[illegible]	[illegible]	.184	[illegible]	[illegible]	-.435	-.444	[illegible]	[illegible]	[illegible]	-.741
																			1.000	[illegible]	-.031	.168	[illegible]	[illegible]	[illegible]	[illegible]	-.261	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																				1.000	-.180	.121	[illegible]	[illegible]	[illegible]	-.117	.134	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																					1.000	[illegible]	[illegible]	[illegible]	[illegible]	.413	[illegible]	.177	-.474	-.080	-.484	-.035	[illegible]	[illegible]
																						1.000	.185	[illegible]	[illegible]	[illegible]	[illegible]	-.331	[illegible]	[illegible]	[illegible]	-.243	[illegible]	[illegible]
																							1.000	[illegible]	.687	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.517	[illegible]
																								1.000	[illegible]	[illegible]	-.168	.181	[illegible]	[illegible]	[illegible]	.231	.505	[illegible]
																									1.000	[illegible]	[illegible]	[illegible]	.016	-.477	[illegible]	.150	[illegible]	[illegible]
																										1.000	[illegible]	.286	-.118	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																											1.000	.410	[illegible]	[illegible]	-.148	.336	.383	.102
																												1.000	[illegible]	[illegible]	.176	[illegible]	.768	[illegible]
																													1.000	[illegible]	.018	[illegible]	[illegible]	[illegible]
																														1.000	-.487	-.502	[illegible]	.375
																															1000	.192	[illegible]	[illegible]
																																1.000	[illegible]	[illegible]
																																	1.000	-.277
																																		1.000

TABLE 4.8--Correlation Matrix for Boys, Age Group 8.

Illustration 4.11. Cluster Analysis on Boys, Age Group 8.

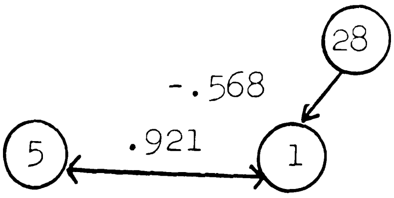
First Cluster of Variables



Number and Name of Variables

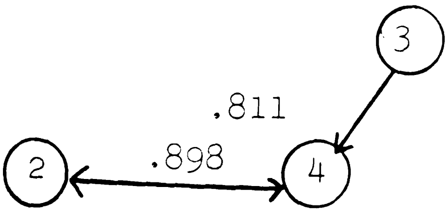
16 Chest Inspiration
10 Weight
15 Upper Arm Circumference
18 Biacromial Diameter
25 Right Grip Strength
12 Triceps Skinfold
14 Abdominal Skinfold
33 Leg Length
9 Height
23 Standing Broad Jump
8 Emotional Stability
11 Sitting Height
13 Subscapular Skinfold
19 Bicristal Diameter

Second Cluster of Variables



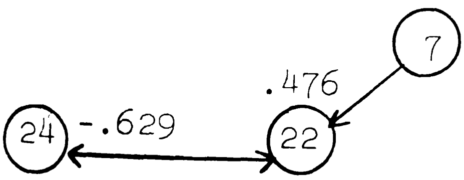
5 Arithmetic
11 Academic Vocabulary
28 Pulse Recovery Rate

Third Cluster of Variables



2 Reading Comprehension
4 Work Study
3 Language

Fourth Cluster of Variables



24 Softball Throw
22 40-Yard Dash
7 Social Approachability

one, measurements of linearity and bone structure clustered with strength and emotional stability, which could indicate a self-concept based on body build at this age level. This was the first time in cluster analyses that boys showed a grouping of an academic variable with social behavior. Again, there was a grouping (fourth cluster) of fat measures and slow pulse recovery rate.

Observing correlation coefficients in Table 4.8 (boys, age group eight), the range in value was between .990 and -.916. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .468, variables #3 (language) and #25 (right grip strength). The highest negative correlation was between variables #7 (social approachability) and #30 (difference between chest inspiration and expiration). Significance at the .05 level was .533 for this age group.

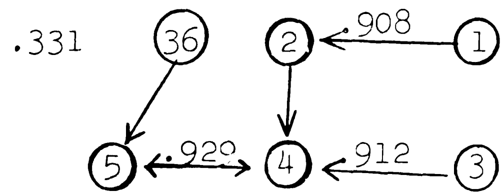
The cluster analysis on boys, age group eight (Illustration 4.11), showed a clustering of the variables: anthropometric-motor-social, academic-motor, academic and motor-social. Body structure clustered with motor performance measurements (strength in broad jump) and with emotional stability, which had been noted previously, both in the clusters in this study and in literature. A new clustering observed at this age level was that of

TABLE 4.—Correlation Matrix ...

	Variable	
23	Reading Comprehension	[illegible]
22	Total Language	[illegible]
21	Total Work Study	[illegible]
20	Total Arithmetic	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
	Sectional Chair	[illegible]
	[illegible]	[illegible]
	Thigh-Calf ...	[illegible]
	Sum of Fat Measurement	[illegible]
	Inspiration-Expiration	[illegible]
	Standing Height	[illegible]
	Sum of Right-Left Grip	[illegible]
	Leg Length	[illegible]
	Sitting Height	[illegible]
	Ponderal Index	[illegible]
	Grade Level	[illegible]

Illustration 4.12. Cluster Analysis on Boys, Age Group 2-8.

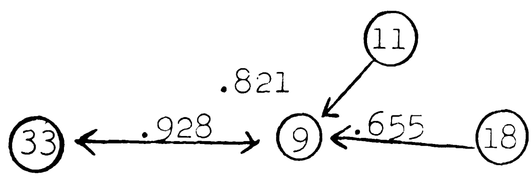
First Cluster of Variables



Number and Name of Variable

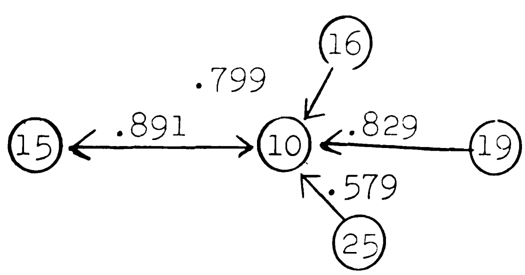
1 Academic Vocabulary
2 Reading Comprehension
4 Work Study
5 Arithmetic
36 Grade

Second Cluster of Variables



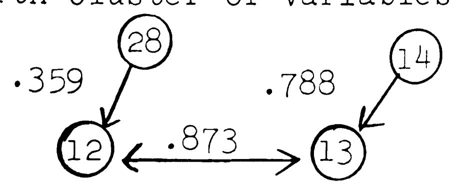
33 Leg Length
9 Height
11 Sitting Height
18 Biacristal Diameter

Third Cluster of Variables



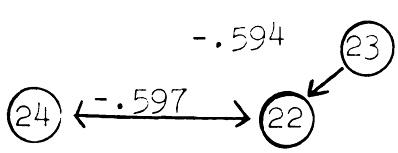
15 Upper Arm Circumference
10 Weight
16 Chest Inspiration
19 Biscistal Diameter
25 Right Grip Strength

Fourth Cluster of Variables



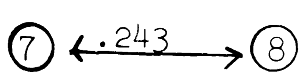
12 Triceps Skinfold
13 Subscapular Skinfold
28 Pulse Recovery Rate
14 Abdominal Skinfold

Fifth Cluster of Variables



24 Softball Throw
22 40-Yard Dash
23 Standing Broad Jump

Sixth Cluster of Variables



7 Social Approachability
8 Emotional Stability

academic and recovery pulse rate. On the basis of data herein presented there is no logical interpretation for this clustering.

Observing correlation coefficients in Table 4.9 (boys, age groups two through eight), the range in value was between .972 and -.611. The highest positive correlation was between variables #4 (work study) and #6 (academic composite). The highest positive correlation between an academic and a variable in another area was .635, variables #4 (work study) and #9 (actual height). The highest negative correlation was between variables #29 (sum of fat measurements) and #35 (ponderal index).

One additional variable was added to the total clusters, which was grade level. This was added to observe correlations between grade level and other variables.

The cluster analysis on boys, age groups two through eight (Illustration 4.12), showed a clustering of the variables: grade level, anthropometric, anthropometric-motor, motor, and social.

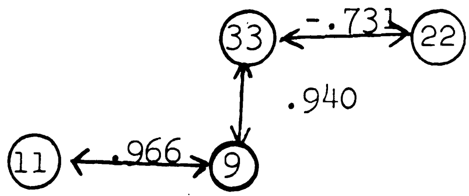
The cluster analysis on boys, age groups 2-8 combined showed an anticipated clustering of the academic variables with the grade level. Linear measurements clustered with hip width (cluster two) and body structure with strength (cluster three). Cluster four showed a grouping of fat measures with low recovery rate, as has been a

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1 Academic Vocabulary	1.000	.636	-.103	.444	.041	.638	-.037	-.405	.230	.027	.088	-.217	-.161	-.177	.010	-.093	-.071	.029	-.005	.474	-.019	-.228	.308	.351	-.172	.374	-.063	-.146	-.218	-.133	.113	.070	.393	.244	.297
2 Reading Comprehension		1.000	.464	.713	-.172	.914	-.068	-.335	.496	.133	.379	.089	.147	-.050	.050	.162	.104	-.193	.003	.395	.090	-.401	.451	.230	-.407	-.049	.168	-.467	.046	.333	-.014	-.272	.597	.533	.459
3 Total Language			1.000	.623	-.368	.618	.111	.046	.356	.088	.337	-.056	-.304	-.390	-.101	.004	-.229	-.235	.456	-.152	.107	-.171	.467	.172	-.020	-.004	-.348	-.578	-.296	.138	-.214	-.014	.343	.410	.256
4 Total Work				1.000	-.009	.853	-.113	-.013	.197	-.330	.048	-.449	-.259	-.263	-.344	-.373	-.402	-.517	.291	.270	-.374	-.069	.805	.270	.130	.243	-.338	-.471	-.382	.109	.050	.193	.373	.200	.738
5 Total Arithmetic					1.000	-.087	-.111	-.012	.236	.238	.166	.151	.108	.419	.390	.138	.209	.221	-.165	.686	.155	-.088	.046	.031	.422	.319	.200	.183	.304	-.368	.936	.407	.304	.084	-.098
6 Academic Composite						1.000	-.013	-.370	.503	.103	.387	-.063	-.127	-.143	.049	.042	.014	-.238	-.154	.322	.067	-.242	.624	.306	-.183	.119	-.085	-.519	-.129	.156	.047	-.056	.602	.531	.480
7 Social Rating							1.000	.022	.334	.178	.450	.120	-.426	-.328	-.072	.153	.109	.385	.392	-.136	.206	.096	-.461	-.046	-.333	-.326	-.254	.122	-.218	-.259	-.204	-.356	.145	.334	.077
8 Emotional Scale								1.000	-.314	-.466	-.315	-.386	-.270	-.274	-.521	-.399	-.415	.102	.666	.081	-.484	.045	-.015	.035	.168	.028	-.547	-.242	-.366	.037	.039	.116	-.280	-.345	.249
9 Actual Height									1.000	.742	.966	.422	.064	.022	.438	.703	.673	.506	.056	.511	.704	-.626	-.030	.477	-.512	-.173	.264	-.496	.202	.242	.416	-.394	.940	.987	.063
10 Actual Weight										1.000	.778	.777	.244	.234	.843	.871	.916	.649	-.191	.296	.993	-.511	-.380	.096	-.312	-.087	.473	-.109	.500	-.140	.391	-.232	.615	.722	-.615
11 Sitting Height											1.000	.548	.043	.082	.506	.772	.728	.554	.073	.354	.773	-.496	-.146	.392	-.567	-.315	.269	-.431	.280	.330	.323	-.494	.820	.465	-.035
12 Triceps Skinfold												1.000	.494	.556	.854	.816	.807	.413	-.343	.096	.778	-.185	-.441	-.317	-.320	-.397	.666	.147	.816	.148	.212	-.381	.212	.407	-.625
13 Subscapular Skinfold													1.000	.734	.352	.537	.507	-.016	-.716	.100	.231	-.152	-.320	-.391	-.318	-.493	.674	.085	.816	.226	.100	-.425	.085	.045	-.231
14 Abdominal Skinfold														1.000	.570	.521	.509	.105	-.518	.103	.211	.303	-.199	-.422	-.096	-.459	.639	.092	.916	.126	.354	-.273	-.056	-.041	-.301
15 Upper Arm Circumference															1.000	.744	.803	.411	-.338	.214	.832	-.151	-.229	-.165	-.040	-.034	.567	.134	.730	-.230	.454	-.040	.303	.368	-.713
16 Chest Inspiration																1.000	.984	.649	-.277	.492	.870	-.345	-.499	-.019	-.596	-.521	.631	-.231	.732	.208	.265	-.628	.538	.722	[illegible]
17 Chest Expiration																	1.000	.653	-.274	.223	.914	-.349	-.511	-.052	-.475	-.393	.600	-.185	.715	.028	.335	-.474	.531	.658	-.577
18 Biacromial Diameter																		1.000	.274	.333	.648	-.292	-.623	.190	-.416	-.168	.033	-.235	.721	-.107	.360	-.333	.376	-.486	-.444
19 Bicristal Diameter																			1.000	.054	-.194	.082	.143	.223	.046	.130	-.865	-.502	-.579	-.048	-.044	.089	.026	.075	.260
20 Standard Weight																				1.000	.188	-.595	.180	.377	-.008	.349	.163	-.239	.117	-.147	.823	.158	.654	.401	.180
21 Relative Weight																					1.000	-.465	-.420	.062	-.328	-.126	.458	-.089	.486	-.131	.298	-.259	.559	.699	-.642
22 40-yard Dash																						1.000	-.022	-.541	.302	-.232	-.309	.301	.042	-.019	-.325	.076	-.733	-.522	-.211
23 Standing Broad Jump																							1.000	.434	.367	.474	-.317	-.362	-.360	.004	.128	.446	.126	-.061	.562
24 Softball Throw																								1.000	-.245	.293	-.221	-.553	-.438	.178	.232	-.013	.538	.460	.415
25 Right Grip Strength																									1.000	.713	-.342	.407	-.257	-.725	.297	.945	-.387	-.537	-.164
26 Left Grip Strength																										1.000	-.377	.157	-.515	-.755	.363	.923	.033	.240	-.053
27 Sit-Reach																											1.000	.274	.811	.246	.180	-.385	.230	.239	-.311
28 Cardio-Vascular Count																												1.000	.130	-.277	-.090	.322	-.529	-.512	-.377
29 Sum of Fat Measurements																													1.000	.179	.294	-.398	.079	.159	-.468
30 Difference-Inspiration-Expiration																														1.000	-.352	-.736	.101	.303	.525
31 Standard Height																															1.000	.351	.494	.264	-.133
32 Sum of Right-Left Grip																																1.000	-.221	-.477	-.130
33 Leg Length																																	1.000	.911	.191
34 Relative Height																																		1.000	.080
35 Ponderal Index																																			1.000

TABLE 4.10--Correlation Matrix for Girls, Age Group 2.

Illustration 4.13. Cluster Analysis on Girls, Age Group 2.

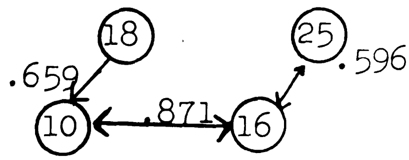
First Cluster of Variables



Number and Name of Variable

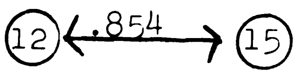
11 Sitting Height
9 Height
33 Leg Length
22 40 Yard Dash

Second Cluster of Variables



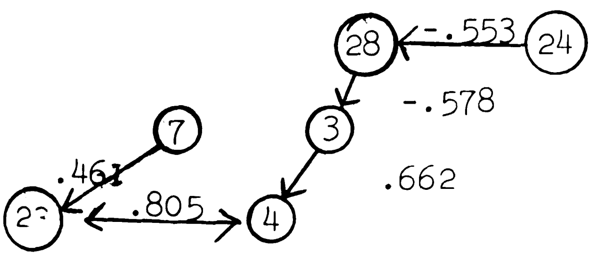
10 Weight
16 Chest Inspiration
18 Biacromial Diameter
25 Right Grip Strength

Third Cluster of Variables



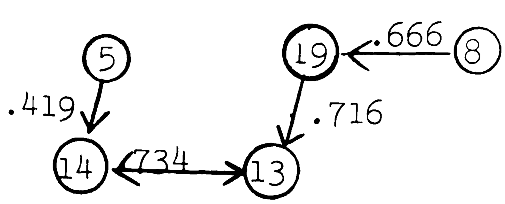
12 Triceps Skinfold
15 Upper Arm Circumference

Fourth Cluster of Variable



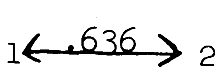
23 Standing Broad Jump
4 Work Study
7 Social Approachability
3 Language
28 Pulse Recovery Rate
24 Softball Throw

Fifth Cluster of Variables



14 Abdominal Skinfold
13 Subscapular Skinfold
5 Arithmetic
19 Bicristal Diameter
8 Emotional Stability

Sixth Cluster of Variables



1 Academic Vocabulary
2 Reading Comprehension

pattern both in the clusters of this study and in other studies. Uncommon to other groupings individually, the fifth cluster shows relationships among the motor performance variables representing coordination, speed and explosive power.

Observing correlation coefficients in Table 4.10 (girls, age group two), the range in value was between .984 and -.796. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .805, variables #4 (work study) and #23 (standing broad jump). The highest negative correlation was between variables #30 (difference between chest inspiration and chest expiration) and #32 (sum of right and left grip). Significance at the .05 level was .553 for this age group.

The cluster analysis on girls, age group two (Illustration 4.13), showed a clustering of the variables: anthropometric-motor, anthropometric, motor-academic-social, anthropometric-academic-social and academic. Linear measurements clustered with physical speed, and strength with body structure and density. The fourth cluster was interesting, showing a grouping of academic variables with general physical condition and with social

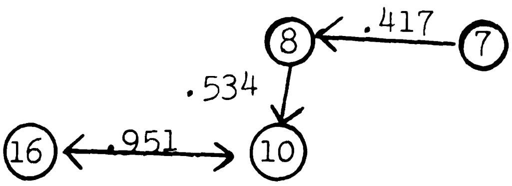
TABLE 4.11--Correlation Matrix for Girls, Age Group [illegible]

Variables: 1 Academic Vocabulary; 2 Reading Comprehension; 3 Total Language; 4 Total Work Study; 5 Total Arithmetic; 6 Academic Composite; 7–21 [illegible]; 22 50 Yard Dash; 23 Standing Broad Jump; 24 Softball Throw; 25 Right Grip Strength; 26 Left Grip Strength; 27 Sit-Reach; 28 Cardio-Vascular Count; 29 Sum of Fat Measurements; 30 Difference-Inspiration-Expiration; 31 Standing Height; 32 Sum of Right-Left Grip; 33 [illegible] Length; 34 Relative Weight; 35 Ponderal Index

	27	28	29	30	31	32	33	34	35
1	[illegible]	[illegible]	.161	[illegible]	[illegible]	[illegible]	[illegible]	.340	[illegible]
2	[illegible]	.179	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	.120	.380	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.174	[illegible]
5	[illegible]	-.065	.025	[illegible]	[illegible]	[illegible]	[illegible]	.149	.077
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.016
7	[illegible]	[illegible]	.073	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.213
8	[illegible]	[illegible]	.271	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	.441	.383	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	.077	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	-.371	[illegible]	[illegible]	[illegible]	[illegible]	.148	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	.129	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.711	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.108
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	-.178	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.604
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	-.307	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.439
24	[illegible]	[illegible]	[illegible]	[illegible]	.129	[illegible]	.110	.489	-.033
25	.174	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.161
26	.170	[illegible]	[illegible]	-.178	[illegible]	[illegible]	[illegible]	[illegible]	-.093
27	1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.057	.358
28		1.000	[illegible]	[illegible]	.450	[illegible]	[illegible]	.106	.168
29			1.000	-.257	[illegible]	[illegible]	.353	[illegible]	-.553
30				1.000	[illegible]	-.187	.084	.216	.275
31					1.000	.608	[illegible]	.125	.027
32						1.000	[illegible]	.445	-.133
33							1.000	.629	.036
34								1.000	.116
35									1.000

<u>Illustration 4.14.</u> Cluster Analysis on Girls, Age Group 3.

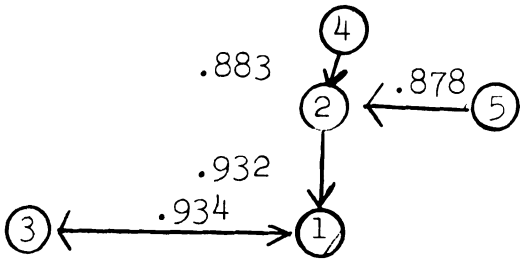
First Cluster of Variables



Number and Name of Variable

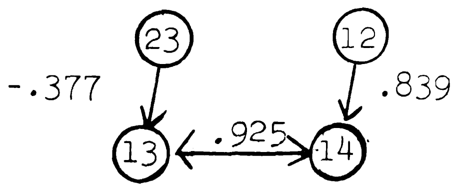
16 Chest Inspiration
10 Weight
8 Emotional Stability
7 Social Approachability

Second Cluster of Variables



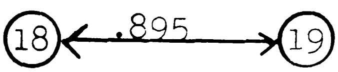
3 Language
1 Academic Vocabulary
2 Reading Comprehension
4 Work Study
5 Arithmetic

Third Cluster of Variables



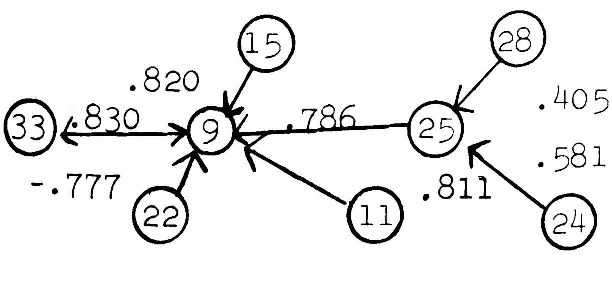
13 Subscapular Skinfold
14 Abdominal Skinfold
23 Standing Broad Jump
12 Triceps Skinfold

Fourth Cluster of Variables



18 Biacromial Diameter
19 Bisristal Diameter

Fifth Cluster of Variables



33 Leg Length
9 Height
15 Upper Arm Circumference
25 Right Grip Strength
11 Sitting Height
22 40 Yard Dash
28 Pulse Recovery Rate
24 Softball Throw

behavior. The fifth cluster grouped fat measurements, body structure, and academic variable and emotional stability.

Observing correlation coefficients in Table 4.11 (girls, age group three), the range in value was between .972 and -.777. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .829, variables #1 (vocabulary) and #33 (leg length). The highest negative correlation was between variables #9 (actual height) and #22 (40-yard dash). Significance at the .05 level was .444 for this age group.

The cluster analysis on girls, age group three (Illustration 4.14), showed a clustering of the variables: anthropometric-social, academic, anthropometric-motor, and anthropometric.

The clusters grouped social-emotional behavior with body density, and fat measurements with the standing broad jump. The fifth cluster showed relationships between linear and body density measurements, strength, speed, coordination and a slow recovery pulse rate, which is unusual according to clusters in other age groups.

Observing correlation coefficients in Table 4.12 (girls age group four), the range in value was between .949 and -.778. The highest positive correlation was

	1	2	3	4	5	6	7	8	9	10	11	12
1 Academic Vocabulary	1.000	.790	.817	.831	.874	.933	-.064	-.018	.353	.230	.034	.176
2 Reading Comprehension		1.000	.695	.787	.796	.884	.047	-.040	.397	.315	.251	.064
3 Total Language			1.000	.864	.842	.917	-.388	-.039	.528	.242	.326	.062
4 Total Work Study				1.000	.836	.935	-.019	.252	.451	.331	.401	.325
5 Total Arithmetic					1.000	.938	-.123	-.049	.579	.276	.256	.140
6 Academic Composite						1.000	-.113	.021	.503	.313	.274	.178
7 Social Rating							1.000	.624	-.088	.200	.013	.233
8 Emotional Scale								1.000	-.043	.089	.211	.060
9 Actual Height									1.000	.744	.604	.243
10 Actual Weight										1.000	.561	.505
11 Sitting Height											1.000	.394
12 Triceps Skinfold												1.000

	13	14	15	16	17	18	19	20	21	22	23	24
1 Academic Vocabulary	.281	.364	.075	.063	-.018	.114	.269	.022	.237	-.375	.113	-.616
2 Reading Comprehension	.240	.479	.124	.230	.115	.189	.278	-.211	.411	-.122	.292	-.459
3 Total Language	.228	.193	-.086	-.050	-.029	.139	.332	.325	.130	-.461	.340	-.417
4 Total Work Study	.393	.492	.144	.125	.076	.099	.318	.144	.295	-.465	.167	-.438
5 Total Arithmetic	.195	.321	-.025	.032	-.102	.233	.187	.090	.251	-.339	.252	-.627
6 Academic Composite	.298	.407	.058	.034	.012	.166	.324	.094	.293	-.383	.251	-.578
7 Social Rating	.045	.403	.415	.366	.051	-.000	-.138	-.358	.353	.429	-.355	.102
8 Emotional Scale	.003	.179	.188	.129	.002	-.100	.031	.132	.018	.131	-.086	.260
9 Actual Height	.173	.326	.372	.359	.329	.706	.577	.352	.611	-.092	.051	-.181
10 Actual Weight	.514	.658	.776	.817	.729	.718	.575	.234	[illegible]	-.009	-.117	.208
11 Sitting Height	.363	.453	.397	.363	.331	.364	.340	.157	[illegible]	-.085	.339	.259
12 Triceps Skinfold	.808	.789	.663	.267	.255	-.043	.022	.210	.440	-.353	-.423	-.003
13 Subscapular Skinfold	1.000	.751	.674	.447	.403	-.038	-.023	.161	.473	-.310	-.362	.018
14 Abdominal Skinfold		1.000	.773	.507	.388	.077	.117	-.060	.767	-.080	-.383	.080
15 Upper Arm Circumference			1.000	.635	.598	.378	.214	.008	.775	-.085	-.301	.454
16 Chest Inspiration				1.000	.856	.685	.415	-.098	.873	.208	-.206	.326
17 Chest Expiration					1.000	.687	.440	.017	.767	.089	-.174	.429
18 Biacromial Diameter						1.000	.608	.023	.717	.089	-.085	.140
19 Bicristal Diameter							1.000	.358	.389	-.104	.157	-.058
20 Standard Weight								1.000	-.138	-.396	.091	-.010
21 Relative Weight									1.000	.135	-.146	.220
22 40-Yard Dash										1.000	.032	.196
23 Standing Broad Jump											1.000	.133
24 Softball Throw												1.000

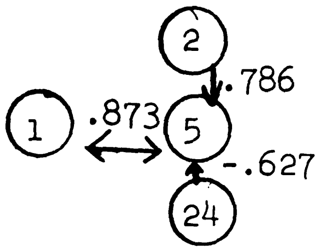
	25	26	27	28	29	30	31	32	33	34	35
1 Academic Vocabulary	.017	.193	-.133	.030	.285	.148	.078	.118	.418	.329	.267
2 Reading Comprehension	-.033	.053	-.110	.030	.269	.164	-.122	.013	.318	[illegible]	.056
3 Total Language	.042	.118	-.275	.023	.163	-.027	.377	.088	.429	[illegible]	.262
4 Total Work Study	.287	.358	-.308	.040	.428	.064	.230	.350	.280	.339	.055
5 Total Arithmetic	-.011	.123	-.287	.303	.230	.250	.129	.065	.544	.526	.305
6 Academic Composite	.061	.182	-.236	.086	.306	.134	.162	.135	.435	.433	.151
7 Social Rating	.227	.108	.125	.046	.273	.515	-.289	.177	-.120	.097	-.396
8 Emotional Scale	.664	.441	-.079	-.126	.099	.280	.234	.588	-.204	-.190	-.153
9 Actual Height	.234	.078	.040	.206	.276	-.033	.391	.163	.823	.815	[illegible]
10 Actual Weight	.464	.383	.046	-.021	.608	-.096	.265	.450	[illegible]	.627	-.561
11 Sitting Height	.437	.266	-.440	.038	.368	-.022	.219	.373	.046	.504	-.164
12 Triceps Skinfold	.281	.556	-.081	.242	.949	-.045	.205	.459	.103	.145	-.456
13 Subscapular Skinfold	.305	.549	-.057	.023	.895	-.029	.118	.467	.030	.119	-.550
14 Abdominal Skinfold	.361	.534	-.118	.074	.923	.101	.021	.487	.056	.346	[illegible]
15 Upper Arm Circumference	.449	.574	-.076	.103	.759	-.007	.029	.254	.121	.328	-.779
16 Chest Inspiration	.437	.305	.093	-.249	.426	.025	-.102	.396	.188	.447	-.737
17 Chest Expiration	.466	.279	.151	-.329	.365	-.496	.018	.395	.176	.341	-.622
18 Biacromial Diameter	.233	-.012	.106	.025	.005	-.178	.009	.111	.628	.742	-.208
19 Bicristal Diameter	.298	.313	.283	-.297	.049	-.155	.426	.330	.482	.343	-.383
20 Standard Weight	.383	.449	.006	-.015	.110	-.196	.972	.450	.330	-.238	.039
21 Relative Weight	.346	.237	.078	-.020	.587	-.016	-.095	.311	.401	.713	-.603
22 40-Yard Dash	-.236	-.460	.451	-.146	-.262	.176	-.378	-.331	-.042	.116	.014
23 Standing Broad Jump	-.071	-.026	-.476	-.068	-.308	-.009	.183	-.051	-.178	-.070	.246
24 Softball Throw	.433	.331	-.192	-.078	.038	-.282	.004	.408	-.433	-.200	-.550
25 Right Grip Strength	1.000	.725	-.148	-.269	.343	-.166	.430	.320	-.018	-.015	-.445
26 Left Grip Strength		1.000	-.225	.031	.520	-.028	.467	.737	-.091	-.203	-.519
27 Sit-Reach			1.000	-.350	-.097	-.127	.036	-.203	.363	.020	.014
28 Cardio-Vascular Count				1.000	.142	.217	-.080	-.119	.231	.263	.297
29 Sum of Fat Measurements					1.000	.011	.129	.510	.084	.227	-.555
30 Difference-Inspiration-Expiration						1.000	-.205	-.100	-.025	.042	.114
31 Standard Height							1.000	.484	.334	-.214	.047
32 Sum of Right-Left Grip								1.000	-.061	-.123	-.521
33 Leg Length									1.000	.664	.218
34 Relative Height										1.000	.099
35 Ponderal Index											1.000

TABLE 4.12--Correlation Matrix for Girls, Age Group 4.

Illustration 4.15. Cluster Analysis on Grils, Age Group 4.

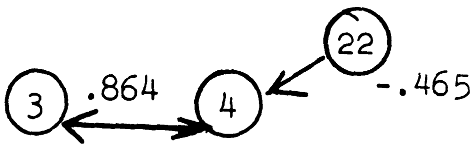
First Cluster of Variables

Number and Name of Variable



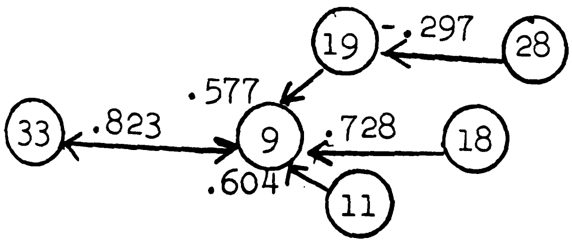
1 Academic Vocabulary
5 Arithmetic
2 Reading Comprehension
24 Softball Throw

Second Cluster of Variables



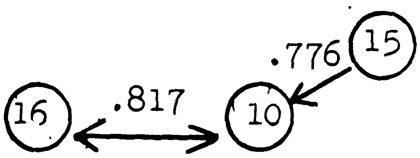
3 Language
4 Work Study
22 40 Yard Dash

Third Cluster of Variables



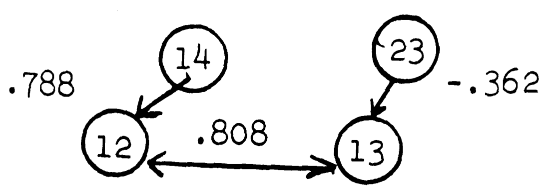
33 Leg Length
9 Height
11 Sitting Height
18 Biacromial Diameter
19 Bicristal Diameter
28 Pulse Recovery Rate

Fourth Cluster of Variables



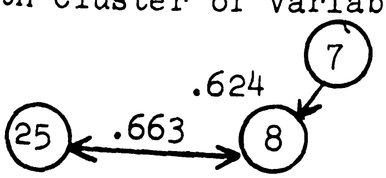
16 Chest Inspiration
10 Weight
15 Upper Arm Circumference

Fifth Cluster of Variables



12 Triceps Skinfold
13 Subscapular Skinfold
14 Abdominal Skinfold
23 Standing Broad Jump

Sixth Cluster of Variables



25 Right Grip Strength
8 Emotional Stability
7 Social Approachability

between variables #12 (triceps skinfold) and #29 (sum of fat measurements). The highest positive correlation between an academic and a variable in another area was .579, variables #5 (arithmetic) and #9 (actual height). The highest negative correlation was between variables #15 (upper arm circumference and #35 (ponderal index). Significance at the .05 level was .456 for this age group.

The cluster analysis on girls, age group four (Illustration 4.15), showed a clustering of the variables: academic-motor, anthropometric-motor, anthropometric, and motor-social. Cluster one showed a grouping of high academic achievement with low coordination, and high academic achievement with speed. Linear measurements and bone measurements clustered with pulse rate recovery. At this age level, body density showed a negative clustering with the standing broad jump. Strength clustered with social-emotional behavior.

Observing correlation coefficients in Table 4.13 (girls, age group five), the range in value was between .978 and -.877. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .634, variables #2 (reading comprehension) and #8 (emotional stability). The highest negative correlation

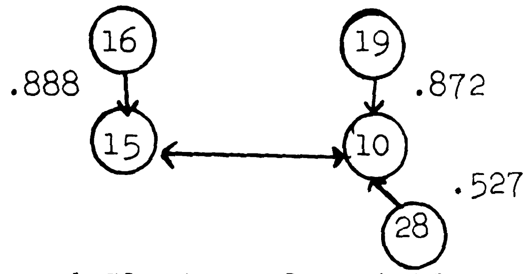
TABLE 4.13--Correlation Matrix for Girls, Age Group 5.

	2 Reading Comprehension	3 Total Language	4 Total Work Study	5 Total Arithmetic	6 Academic Composite	7 Social Rating	8 Emotional Scale	9 Actual Height	10 Actual Weight	11 Sitting Height	12 Triceps Skinfold	13 Subscapular Skinfold	14 Abdominal Skinfold
1 Academic Vocabulary	.723	.807	.761	.714	.857	.217	.651	.104	-.071	-.081	-.065	-.144	-.133
2	1.000	.937	.903	.870	.924	.015	.634	.333	.208	.131	.198	.099	.025
3		1.000	.845	.774	[illegible]	-.022	[illegible]	.170	.137	.010	.087	.000	-.083
4			1.000	.860	[illegible]	-.095	[illegible]	.230	.106	-.043	.107	-.037	.003
5				1.000	[illegible]	-.136	[illegible]	.330	.228	.057	.251	.105	.058
6					1.000	-.009	.617	.229	.098	.066	.098	-.019	-.052
7						1.000	.379	-.283	-.199	.114	-.134	-.049	-.033
8							1.000	.041	-.085	.097	.025	-.022	-.091
9								1.000	.723	.117	.438	.449	.461
10									1.000	.223	.822	.854	.803
11										1.000	.247	.335	.119
12											1.000	.859	.833
13												1.000	.850
14													1.000

	15 Upper Arm Circumference	16 Chest Inspiration	17 Chest Expiration	18 Bisacromial Diameter	19 Bicristal Diameter	20 Standard Weight	21 Relative Weight	22 40-Yard Dash	23 Standing Broad Jump	24 Softball Throw	25 Right Grip Strength	26 Left Grip Strength	27 Sit-Reach	28 Cardio-Vascular Count	29 Sum of Fat Measurements	30 Difference-Inspiration-Expiration	31 Standard Height	32 Sum of Right-Left Grip	33 Leg Length	34 Relative Height	35 Ponderal Index
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16		1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17			1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18				1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19					1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20						1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21							1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22								1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23									1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24										1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25											1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26												1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27													1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28														1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29															1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30																1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31																	1.000	[illegible]	[illegible]	[illegible]	[illegible]
32																		1.000	[illegible]	[illegible]	[illegible]
33																			1.000	[illegible]	[illegible]
34																				1.000	[illegible]
35																					1.000

Illustration 4.16 Cluster Analysis on Girls, Age Group 5.

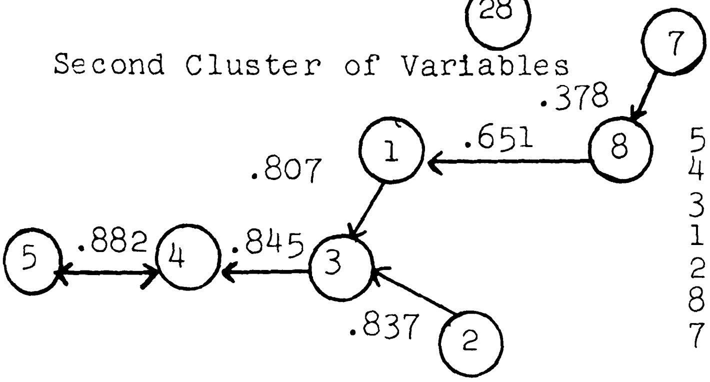
First Cluster of Variables



Number and Name of Variable

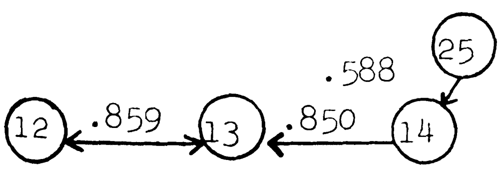
15 Upper Arm Circumference
10 Weight
16 Chest Inspiration
19 Bicristal Diameter
28 Pulse Recovery Rate

Second Cluster of Variables



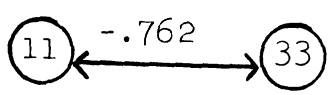
5 Arithmetic
4 Work Study
3 Language
1 Academic Vocabulary
2 Reading Comprehension
8 Emotional Stability
7 Social Approachability

Third Cluster of Variables



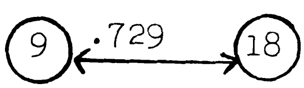
12 Triceps Skinfold
13 Subscapular Skinfold
14 Abdominal Skinfold
25 Right Grip Strength

Fourth Cluster of Variables



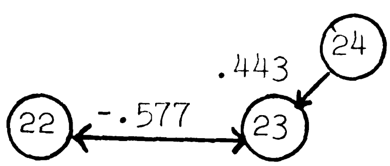
11 Sitting Height
33 Leg Length

Fifth Cluster of Variables



9 Height
18 Biacromial Diameter

Sixth Cluster of Variables



22 40-Yard Dash
23 Standing Broad Jump
24 Softball Throw

was between variables #15 (upper arm circumference) and #35 (ponderal index). Significance at the .05 level was .339 for this age group.

The cluster analysis on girls, age group five (Illus- 4.13), showed a clustering of the variables: anthropometric-motor, academic-social, anthropometric, and motor. Again body density clustered with pulse rate recovery, which has been shown in many tests (that the obese person has a rapid pulse rate following exercise, or a slow recovery rate to normal heart beat). This was the first cluster, boys or girls to cluster all academic and all social-emotional behavior variables--to one group. Body linearity and strength clustered, and motor performance variables clustered.

Observing correlation coefficients in Table 4.14 (girls, age group six), the range in value was between .979 and -.828. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .572, variables #5 (arithmetic) and #23 (standing broad jump). The highest negative correlation was between variables #15 (upper arm circumference) and #35 (ponderal index). Significance at the .05 level was .381 for this age group.

TABLE .14--Correlation Matrix for Girls, Age Group [illegible]

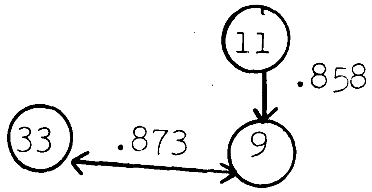
Row	1 [illegible]	2 Reading Comprehension	3 Total Language	4 Total Work Study	5 Total Arithmetic	6 Academic Composite	7 Social Rating	8 Emotional Scale	9 Actual Height	10 Actual Weight
1	1.000	.749	.687	.651	[illegible]	.914	.307	.149	[illegible]	[illegible]
2		1.000	.726	.756	[illegible]	.906	.316	.390	[illegible]	[illegible]
3			1.000	.830	.738	[illegible]	.254	[illegible]	[illegible]	[illegible]
4				1.000	.919	.919	.354	[illegible]	[illegible]	[illegible]
5					1.000	.888	[illegible]	[illegible]	[illegible]	[illegible]
6						1.000	[illegible]	[illegible]	[illegible]	[illegible]
7							1.000	[illegible]	.191	[illegible]
8								1.000	[illegible]	[illegible]
9									1.000	[illegible]
10										1.000

Row	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25 Right Grip Strength	26 Left Grip Strength
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.048	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.186
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19									[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20										[illegible]	[illegible]	-.404	.413	[illegible]	[illegible]	[illegible]
21											1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22												1.000	-.092	-.567	[illegible]	[illegible]
23													1.000	[illegible]	.382	[illegible]
24														1.000	[illegible]	.244
25															1.000	[illegible]
26																1.000

Row	27 Sit-Reach	28 Cardio-Vascular Count	29 Sum of Fat Measurement	30 Difference-Inspiration-Expiration	31 Standard Height	32 Sum of Right-Left Grip	33 Leg Length	34 Relative Height	35 Ponderal Index
1	[illegible]	-.346	-.184	-.024	.417	-.036	-.222	-.326	.232
2	-.068	-.446	-.226	.224	[illegible]	-.195	.035	-.327	.190
3	.059	-.269	-.115	.008	.440	-.108	-.052	-.376	.181
4	-.145	-.220	-.006	.101	.462	.193	.168	-.375	.263
5	.137	-.328	-.141	.154	.677	.174	.357	-.267	.300
6	.133	-.360	-.158	.115	.526	-.000	.046	-.411	.263
7	-.106	-.071	.119	-.031	.009	.051	.364	.158	-.297
8	.019	-.066	.074	.009	-.149	.074	.131	.156	-.218
9	.128	-.027	.176	.178	.501	.365	.873	.446	.047
10	-.010	.075	.685	-.265	.176	.338	.601	.447	-.622
11	.251	-.053	.259	-.031	.476	.242	.500	.373	.022
12	-.156	.350	.932	-.382	.201	.411	.046	.296	-.742
13	-.086	.146	.929	-.587	-.007	.360	.080	.169	-.751
14	.056	.373	.951	-.621	.059	.397	.028	.114	-.651
15	.039	.171	.840	-.505	.006	.353	.237	.321	-.628
16	-.068	-.053	.730	-.327	.068	.358	.237	.339	-.637
17	-.032	-.016	.844	-.507	.050	.332	.170	.294	-.686
18	.187	.010	.457	-.123	.181	.204	.484	.429	-.237
19	.185	.035	.632	-.310	.145	.382	.393	.358	-.424
20	.212	-.163	-.119	.206	.822	.256	.336	-.314	.476
21	-.088	.129	.692	-.328	-.141	.216	.436	.472	-.804
22	-.110	-.077	.206	-.445	-.199	-.445	[illegible]	-.041	-.363
23	.172	.058	-.179	.376	.435	.37[illegible]	[illegible]	-.02[illegible]	.392
24	.362	.006	.132	.167	.438	.492	.384	-.008	-.013
25	.140	.108	.455	-.014	.190	.861	.207	.066	-.188
26	-.039	.035	.232	-.059	.159	.903	.471	.196	-.058
27	1.000	-.112	-.04[illegible]	-.197	.207	.049	-.0[illegible]	-.076	.121
28		1.000	.314	.1[illegible]	-.010	.078	.002	.164	-.089
29			1.000	[illegible]	-.045	.380	[illegible]	.101	-.756
30				1.000	.057	-.24[illegible]	.21[illegible]	.071	.436
31					1.000	.194	.37[illegible]	-.54[illegible]	.263
32						1.000	[illegible]	.150	-.134
33							1.000	.437	.058
34								1.000	-.206
35									1.000

Illustration 4.17. Cluster Analysis on Girls, Age Group 6.

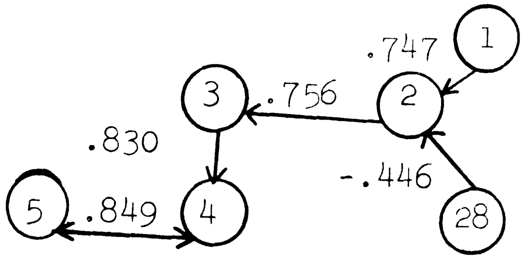
First Cluster of Variables



Number and Name of Variable

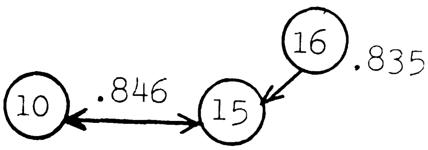
33 Leg Length
9 Height
11 Sitting Height

Second Cluster of Variables



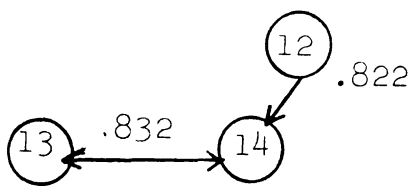
5 Arithmetic
4 Work Study
3 Language
2 Reading Comprehension
1 Academic Vocabulary
28 Pulse Recovery Rate

Third Cluster of Variables



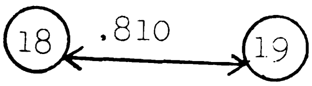
10 Weight
15 Upper Arm Circumference
16 Chest Inspiration

Fourth Cluster of Variables



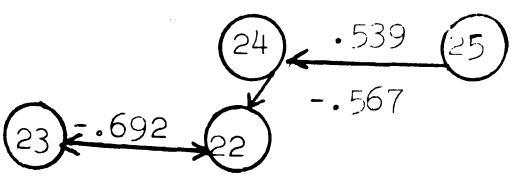
13 Subscapular Skinfold
14 Abdominal Skinfold
12 Triceps Skinfold

Fifth Cluster of Variables



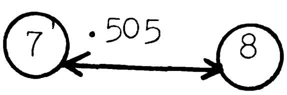
18 Biacromial Diameter
19 Bicristal Diameter

Sixth Cluster of Variables



23 Standing Broad Jump
22 40 Yard Dash
24 Softball Throw
25 Right Grip Strength

Seventh Cluster of Variables



7 Social Approachability
8 Emotional Stability

The cluster analysis on girls, age group six (Illustration 4.17), showed a clustering of the variables: anthropometric, academic-motor, motor and social. The pattern for this age group was unique in that nearly all clusters were within a single area: linear measurements, body density, bone structure, motor performance and social-emotional behavior. The one exceptional cluster was that which negatively correlated pulse rate recovery with academic variables.

Observing correlation coefficients in Table 4.15 (girls, age group 7), the range in value was between .988 and -.935. The highest positive correlation was between variables #16 (chest inspiration) and #17 (chest expiration). The highest positive correlation between an academic and a variable in another area was .583, variables #3 (language) and #23 (standing broad jump). The highest negative correlation was between variables #29 (sum of fat measurements) and #35 (ponderal index). Significance at the .05 level was .468 for this age group.

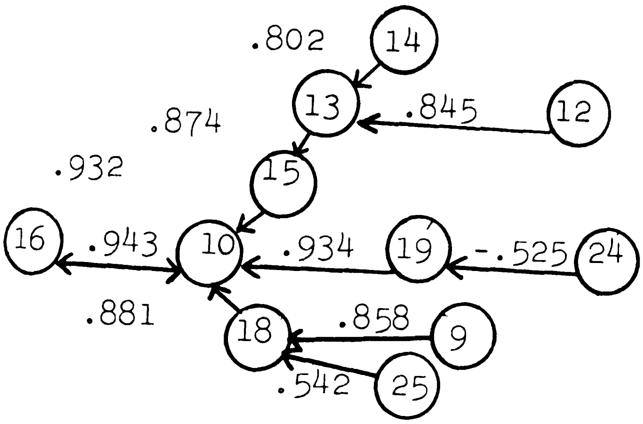
The cluster analysis on girls, age group seven (Illustration 4.18), showed a clustering of the variables: anthropometric, academic, motor and academic-social. Body density and structure clustered with strength, but negatively with coordination (softball throw), which deviates some from the general pattern. It was difficult

TABLE 4.15--Correlation Matrix for Girls, Age Group 7.

	1 Academic Vocabulary	2 Reading Comprehension	3 Total Language	4 Total Work Study	5 Total Arithmetic	6 Academic Composite	7 Social Rating	8 Emotional Scale	9 Actual Height	10 Actual Weight	11 Sitting Height	12 Triceps Skinfold	13 Subscapular Skinfold	14 Abdominal Skinfold	15 Upper Arm Circumference	16 Chest Inspiration	17 Chest Expiration	18 Biacromial Diameter	19 Bicristal Diameter	20 Standard Weight	21 Relative Weight	22 40-yard Dash	23 Standing Broad Jump	24 Softball Throw	25 Right Grip Strength	26 Left Grip Strength	27 Sit-Reach	28 Cardio-Vascular Count	29 Sum of Fat Measurements	30 Difference-Inspiration-Expiration	31 Standard Height	32 Sum of Right-Left Grip	33 Left Length	34 Relative Height	35 Ponderal Index
1	[illegible]	[illegible]	[illegible]	.304	.717	[illegible]	-.451	-.104	.132	.071	[illegible]	-.110	-.215	-.247	-.016	.063	-.097	[illegible]	-.091	-.264	.119	-.220	.228	.074	-.262	-.541	-.012	-.192	-.217	.441	-.243	-.424	.247	[illegible]	.165
2		[illegible]	[illegible]	[illegible]	.846	.420	-.457	-.062	.152	[illegible]	-.074	-.139	-.257	-.135	[illegible]	.018	[illegible]	[illegible]	[illegible]	[illegible]	.069	-.363	.442	.044	-.173	-.469	-.158	-.131	-.252	.222	-.080	-.249	.141	.177	.147
3			1.000	.817	.722	[illegible]	-.280	-.108	.287	.265	[illegible]	-.154	-.119	[illegible]	.078	.147	[illegible]	.176	.135	-.196	[illegible]	-.417	.493	-.146	.013	[illegible]	-.289	-.065	-.192	-.177	-.166	-.176	.355	.444	.368
4				1.000	.867	.367	-.472	[illegible]	.144	.034	-.048	[illegible]	-.218	-.139	-.017	.090	[illegible]	.144	-.044	[illegible]	[illegible]	[illegible]	.437	.086	-.146	-.283	-.230	-.247	-.270	.393	-.035	-.170	.124	[illegible]	[illegible]
5					1.000	[illegible]	-.518	-.233	.178	.062	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.031	[illegible]	-.444	.262	.164	.112	-.084	-.330	-.170	-.308	[illegible]	.054	[illegible]	.115	.145	[illegible]
6						1.000	-.469	-.149	[illegible]	[illegible]	-.174	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.011	[illegible]	.144	-.335	.467	[illegible]	[illegible]	-.365	-.218	-.190	[illegible]	[illegible]	-.116	[illegible]	[illegible]	[illegible]	[illegible]
7							1.000	.366	.411	[illegible]	[illegible]	[illegible]	.454	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.386	[illegible]	[illegible]	.144	-.092	[illegible]	[illegible]	[illegible]	[illegible]	.270	.410	-.163	[illegible]	[illegible]	.031	[illegible]	[illegible]
8								1.000	.161	.147	[illegible]	[illegible]	.331	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.111	[illegible]	[illegible]	.018	[illegible]	[illegible]	.310	[illegible]	-.213	[illegible]	[illegible]	[illegible]	[illegible]
9									1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.154	.434	[illegible]	.231	[illegible]	[illegible]	[illegible]	-.335
10										1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.338	.196	.076	.799	[illegible]	[illegible]	.434	[illegible]	[illegible]	[illegible]
11											1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.464	.018	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12												1.000	[illegible]	[illegible]	[illegible]	[illegible]	.716	[illegible]	[illegible]	[illegible]	[illegible]	-.217	[illegible]	[illegible]	.115	[illegible]	.412	.047	[illegible]	[illegible]	[illegible]	.165	[illegible]	[illegible]	[illegible]
13													1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.119	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14														1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.327	[illegible]	.054	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15															1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.080	[illegible]	[illegible]	.087	.461	[illegible]	.186	.864	[illegible]	[illegible]	.347	[illegible]	[illegible]	[illegible]
16																1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.179	[illegible]	.281	[illegible]	[illegible]	.053	[illegible]	[illegible]	-.076	[illegible]	[illegible]	[illegible]	[illegible]
17																	1.000	[illegible]	[illegible]	[illegible]	[illegible]	-.097	-.141	[illegible]	[illegible]	[illegible]	[illegible]	.115	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18																		1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.177	[illegible]	[illegible]	.111	.088	.572	.021	.243	[illegible]	[illegible]	[illegible]	[illegible]
19																			1.000	[illegible]	[illegible]	[illegible]	.032	[illegible]	[illegible]	[illegible]	.162	.246	.762	-.350	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20																				1.000	[illegible]	-.238	[illegible]	.310	[illegible]	[illegible]	-.160	.008	-.181	-.197	.932	[illegible]	[illegible]	[illegible]	[illegible]
21																					1.000	-.049	-.043	-.386	[illegible]	[illegible]	[illegible]	.007	[illegible]	[illegible]	[illegible]	.317	.330	[illegible]	[illegible]
22																						1.000	-.830	-.010	[illegible]	.133	.257	[illegible]	.033	.168	-.265	-.080	[illegible]	-.193	-.090
23																							1.000	.074	.390	-.019	[illegible]	[illegible]	-.292	-.218	.260	.205	-.032	[illegible]	-.306
24																								1.000	[illegible]	.027	-.215	-.233	-.334	.393	.134	[illegible]	[illegible]	[illegible]	[illegible]
25																									1.000	[illegible]	-.315	.416	.111	-.331	[illegible]	[illegible]	[illegible]	.317	[illegible]
26																										1.000	-.151	.417	.367	-.467	[illegible]	[illegible]	-.355	.141	[illegible]
27																											1.000	.049	[illegible]	.092	-.214	-.255	.098	.116	[illegible]
28																												1.000	[illegible]	-.413	-.005	.447	-.417	[illegible]	[illegible]
29																													1.000	-.405	-.224	[illegible]	.162	[illegible]	[illegible]
30																														1.000	-.125	[illegible]	[illegible]	[illegible]	[illegible]
31																															1.000	[illegible]	[illegible]	-.189	[illegible]
32																																1.000	[illegible]	[illegible]	-.176
33																																	1.000	.383	-.214
34																																		1.000	[illegible]
35																																			1.000

Illustration 4.18. Cluster Analysis on Girls, Age Group 7.

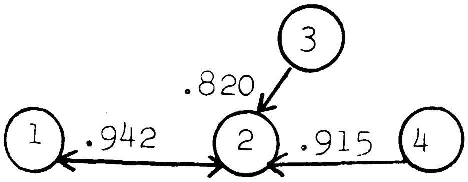
First Cluster of Variables



Name and Number of Variable

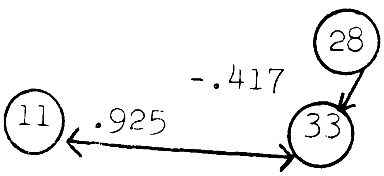
16 Chest Inspiration
10 Actual Weight
19 Bicristal Diameter
15 Upper Arm Circumference
18 Biacromial Diameter
9 Actual Height
13 Subscapular Skinfold
25 Right Grip Strength
24 Softball Throw
12 Triceps Skinfold
14 Abdominal Skinfold

Second Cluster of Variables



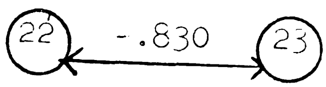
1 Academic Vocabulary
2 Reading Comprehension
4 Work Study
3 Language

Third Cluster of Variables



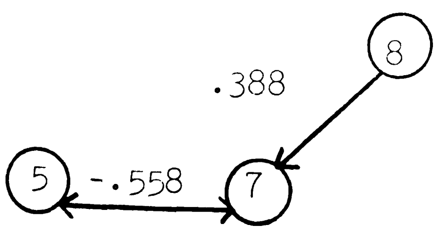
11 Sitting Height
33 Leg Length
28 Pulse Recovery Rate

Fourth Cluster of Variables



22 40 Yard Dash
23 Standing Broad Jump

Fifth Cluster of Variables



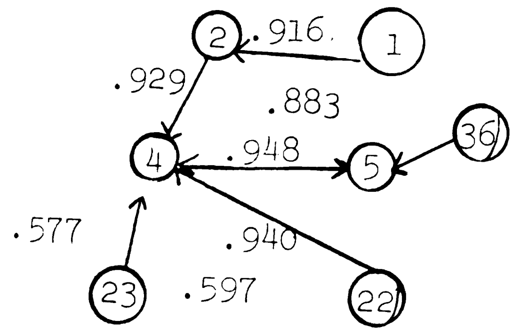
5 Arithmetic
7 Social Approachability
8 Emotional Stability

Reading Comprehension 2	Total Language 3	Total Work Study 4	Total Arithmetic 5	Academic Composite 6	Social Rating 7	Emotional Scale 8	Actual Height 9	Actual Weight 10	Sitting Height 11	Triceps Skinfold 12	Subscapular Skinfold 13	Abdominal Skinfold 14	Upper Arm Circumference 15	Chest Inspiration 16	Chest Expiration 17	Biacromial Diameter 18	Bicristal Diameter 19	Standard Weight 20	Relative Weight 21	40-Yard Dash 22	Standing Broad Jump 23	Softball Throw 24	Right Grip Strength 25	Left Grip Strength 26	Sit-Reach 27	Cardio-Vascular Count 28	Sum of Fat Measurements 29	Difference-Inspiration Expiration 30	Standard Height 31	Sum of Right-Left Grip 32	Left Length 33	Relative Height 34	Ponderal Index 35	Grade Level 36
.916	.907	[illegible]	.881	[illegible]	[illegible]	.271	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.445	.416	.374	.031	.096	.134	.105	.707	.421	.326	-.037	.125	.796
1.000	.918	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.415	.023	.092	.190	.092	.709	.444	.319	.060	.087	.807
	1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.435	[illegible]	.444	-.024	.142	.189	[illegible]	[illegible]	.472	.362	.028	.080	.854
		1.000	.948	.977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.526	.527	.512	-.013	.094	.217	.092	.748	.539	.337	-.001	.109	.881
			1.000	[illegible]	.017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.510	.510	.441	[illegible]	.116	.210	.100	.745	.530	.354	.034	.122	.883
				1.000	.048	.271	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.562	.487	.486	.463	[illegible]	.106	.192	.066	.775	.492	.351	.001	.107	.870
					1.000	.425	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.034	.070	.109	.083	.031	.098	.011	.116	-.167	.012
						1.000	.140	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.171	.170	.255	.146	[illegible]	-.031	.069	.140	.015	.019	.143	.022	.110	-.110	.149
							1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.584	.481	.504	.667	.648	.083	.188	.408	.049	.737	.682	.497	.535	-.029	.744
								1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.214	.359	[illegible]	[illegible]	.077	.226	.772	-.157	.430	.601	.374	.530	-.598	.501
									1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.320	.401	[illegible]	[illegible]	.163	.248	-.033	.398	.405	-.643	.175	-.070	.309
										1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.134	.047	.231	.434	[illegible]	[illegible]	.254	.912	-.248	.198	.406	.152	.338	-.678	.268
											1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.045	.195	.414	.345	.125	.192	.936	-.319	.190	.417	.117	.352	-.710	.212
												1.000	[illegible]	[illegible]	.715	[illegible]	[illegible]	[illegible]	[illegible]	-.040	.047	.258	[illegible]	.434	.145	.160	.958	-.242	.239	.443	.175	.261	[illegible]	.273
													1.000	[illegible]	.871	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.254	.453	.444	[illegible]	[illegible]	.851	-.257	.261	.465	.186	.400	-.796	.277
														1.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.166	.048	.223	[illegible]	[illegible]	.112	[illegible]	[illegible]	-.112	.332	.474	.267	.476	-.629	.347
															1.000	[illegible]	[illegible]	.274	[illegible]	-.176	[illegible]	.200	[illegible]	.444	.118	.119	.780	-.325	.306	.467	.228	.436	-.671	.316
																1.000	[illegible]	[illegible]	[illegible]	-.361	.240	.405	[illegible]	.670	.071	.130	.501	-.040	.531	.611	.331	.508	-.272	.541
																	1.000	[illegible]	[illegible]	[illegible]	.238	.288	[illegible]	[illegible]	[illegible]	.143	.627	.174	.442	.562	.087	.437	-.387	.464
																		1.000	[illegible]	[illegible]	.610	.612	.671	.640	[illegible]	.134	.214	.020	.962	.651	.068	-.119	.131	.917
																			1.000	[illegible]	[illegible]	[illegible]	.314	.296	[illegible]	.164	.700	-.187	.041	.317	.273	.673	-.762	.072
																				1.000	[illegible]	-.489	[illegible]	[illegible]	[illegible]	-.043	-.064	-.102	-.612	[illegible]	-.343	-.101	-.226	-.644
																					1.000	.555	.470	.434	-.163	.013	.043	.099	.473	.480	.257	-.014	.298	.613
																						1.000	.547	.571	[illegible]	.021	.244	.056	[illegible]	[illegible]	.164	-.003	.010	.585
																							1.000	.963	[illegible]	.139	.437	-.064	.646	.969	.019	.150	-.158	.650
																								1.000	-.107	.011	.437	-.074	.631	.960	.065	.155	-.140	.633
																									1.000	.060	.126	[illegible]	.011	-.134	.076	.108	-.021	-.033
																										1.000	.255	-.108	.104	.211	.008	.138	-.116	.153
																											1.000	-.282	.228	.486	.163	.327	-.721	.272
																												1.000	[illegible]	-.071	.078	.076	.334	.065
																													1.000	.669	.308	-.174	.109	.916
																														1.000	.249	.158	-.155	.665
																															1.000	.335	.041	.401
																																1.000	-.161	-.051
																																	1.000	.115
																																		1.000

TABLE 4.16--Correlation Matrix for Girls, Age Group [illegible]-7.
N=119

Illustration 4.19. Cluster Analysis on Girls, Age Group 2-7.

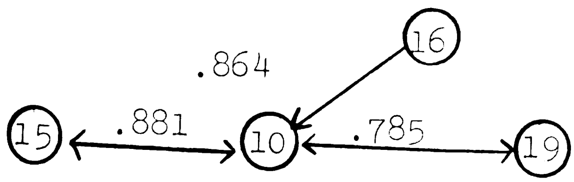
First Cluster of Variables



Number and Name of Variable

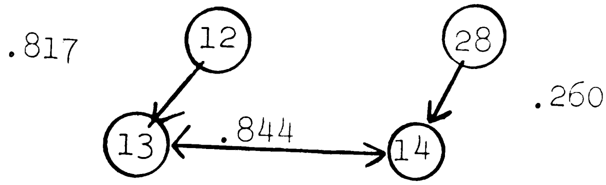
1 Academic Vocabulary
2 Reading Comprehension
3 Language
4 Work Study
5 Arithmetic
22 40 Yard Dash
23 Standing Broad Jump
36 Age Level

Second Cluster of Variables



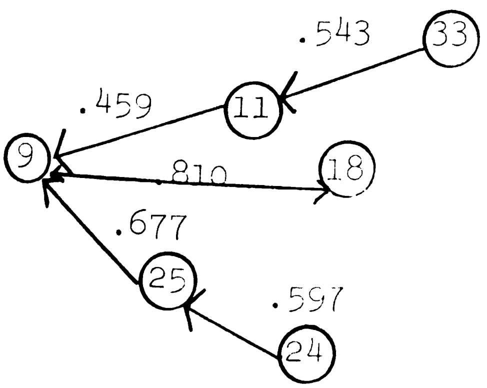
15 Upper Arm Circumference
10 Weight
16 Chest Inspiration
19 Bicristal Diameter

Third Cluster of Variables



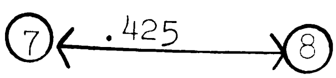
13 Subscapular Skinfold
14 Abdominal Skinfold
12 Triceps Skinfold
28 Pulse Recovery Rate

Fourth Cluster of Variables



9 Height
11 Sitting Height
18 Bricromial Diameter
25 Right Grip Strength
33 Leg Length
24 Softball Throw

Fifth Cluster of Variables



7 Social Approachability
8 Emotional Stability

to access the negative relationship between linear measurements, unless there was error in original recording. It was also difficult to access the negative relationship between arithmetic and social-emotional behavior.

Observing correlation coefficients in Table 4.16 (girls, age groups two through seven), the range in value was between .977 and -.796. The highest positive correlation was between variables #4 (work study) and #6 (academic composite). The highest positive correlation between an academic and an unrelated variable was .704, variables #5 (arithmetic) and #9 (actual height.) The highest negative correlation was between variables #16 (chest inspiration) and #35 (ponderal index).

The cluster analysis on girls, age groups two through seven (Illustration 4.19), showed a clustering of the variables: academic-motor-grade level, academic, anthropometric, anthropometric-motor and social. The first cluster showed groupings of all academic variables with 40-yard dash, standing broad jump and grade level. Body density clustered with bone measurement. For the first time in girls fat measurements clustered positively with pulse recovery rate, which was contradictory to literature and to other findings in this study. Clustering showed negative correlations among linear measurements and positive clusters with strength and coordinative

measurements. Agsin, the negative correlations are difficult to understand as they contradict previous findings.

Discussion on Intercorrelations

Observing the highest positive correlation coefficients, it was found that there were generally high correlations among variables within the academic area. The most frequent were work study, academic vocabulary and language with composite academic achievement.

Observing highest positive correlation coefficients between areas, it was found that there were correlations between anthropometric measurements and academic components, and between anthropometric measurements and motor components. The most frequent were between work study and height and bicristal diameter, and between arithmetic and height. Other correlations were between language and right grip strength, work study and cardiovascular pulse rate, and arithmetic and softball throw.

Observing highest negative correlation coefficients, it was found that there were correlations between ponderal index and emotional stability, sum and components of fat measurements and circumference measurements. There were also negative correlations between chest expiration and the difference between inspiration and expiration and between social approachability and chest expiration. The latter two appear to

to be without reasonable explanation. However, the ponderal index is computed with high indices for the linear or slender body build and with low indices for the ponderous or heavy body build, which accounts for the negative correlation since fat and weight-bearing measurements are taken directly from the subject (the heavy child would have a high fat reading and a low ponderal index).

Discussion on Clusters

Observing clusters at the various age levels, certain patterns appeared:

Cluster analyses showed that there were more clusters between social, anthropometric and motor than between academic and social, anthropometric and motor.

The socio-anthropometric-motor clustering appeared frequently with boys, but not at all with girls. It is accepted that sex differences appear in the elementary school age levels, which may have a bearing on motor performance and in turn, on social acceptability.

1. Weight and chest inspiration clustered in all boy's age levels including the boys' total. In addition to weight and chest inspiration, upper arm circumference and biacromial diameter clustered in boys age groups two through six and boys age group eight. Boys age groups three, five, six and eight also added bicristal

diameter to this cluster. Boys age groups five and eight added height measurements and grip strength. Boys age groups six and eight added the three skinfold measurements to the cluster.

2. Academic variables clustered together in some ways in all boys age levels including the boys total. In boys age groups two, four, six and total all five variables clustered (boys age group four also added right grip and softball throw). Boys age groups three, five and seven included separate clusterings of the academic variables with from zero to three variables.

3. As was anticipated all three height measurements (actual height, sitting height and leg length) clustered at all levels in the boys age groups. In addition to this cluster, boys age level two added the three skinfold measurements (as did boys age level eight) and social approachability. Boys age level four added emotional stability (as did boys age levels five, seven and eight). Boys age levels five and eight also added weights, chest inspiration, upper arm circumference, the two diameter measurements and grip strength.

4. Boys age groups three, four, five, six, seven and total showed clusters of the three skinfold measurements with pulse recovery rate.

5. Boys at all age levels, including the total showed clusters of the 40-yard dash and the standing broad jump.

Softball throw was added to this cluster at boys age levels five, seven and total.

6. Chest inspiration and weights clustered together in all girls age levels including the girls total. In girls age groups four, five, six, seven and eight, upper arm circumference was added to this cluster. In girls age groups five, seven and total, bicristal diameter was added to the chest inspiration-weights cluster.

7. Some academic variables clustered in all girls age levels. In girls age levels three, five, six and total, all five academic variables clustered together, with from zero to two additional factors.

8. As was anticipated, leg length and sitting height clustered in all girls age levels (height was also clustered in all girls age levels except age level seven). Grip strength and softball throw were added to this cluster in girls age levels three and total.

9. As was anticipated, the three skinfold measurements clustered in all girls age levels except age level two. Standing broad jump was added to this cluster in girls age levels three and four. Grip strength was added in girls age levels five and seven.

10. In all age levels, boys and girls chest inspiration and weight appeared in a cluster. In all the boys age levels and all except two of the girls age levels, upper arm circumference was added to this cluster.

11. In all age levels, boys and girls clusters showed some grouping within the academic area. No pattern seemed to emerge regarding additional clustering, as some age levels, boys and girls, added up to three other variables in the area of motor performance and social-emotional behavior.

12. In all age levels for boys and girls (except for one age level) leg length, sitting height and height clustered together, which was anticipated. Softball throw was added to this age level three for boys and girls.

13. Skinfold measurements clustered at all age levels in boys and girls with the exception of girls age level two. In all boys age groups except age group two, pulse recovery rate was added to this cluster. The girls total also added the pulse recovery rate.

14. The forty-yard dash and the softball throw appeared as a cluster in all boys age levels, but this did not appear consistently in the girls clusters.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The growth and function of components within a child are interrelated to the extent that each affects the other, and thus creates individual capacities for achievement and performance.

Summary of the Study

The context of this study was extracted from one of the hypotheses of Project "E," namely, that interrelationships exist among cognitive, socio-personal and psychomotor factors. The study was made to search out evidence of these interrelationships and to relate implications of the findings to curriculum development. For example, correlations between academic achievement and body structure would suggest that the classroom teacher and the physical education specialist should work together in analyzing records, planning curriculum and evaluating pupil progress.

An existing school situation and a working relationship between the physical ecuation departments of Michigan State University and the Pontiac, Michigan, Public Schools served as catalysts for conducting the study. The study utilized three schools and nearly

1,500 children in a battery of tests and measurements of thirty-five variables.

There were two steps to the study program itself: (1) the establishment of normative data and (2) the programming for determining interrelationships. Data were gathered from test batteries and pupil records in the areas of concern.

Conclusions from the Data

There was evidence in this study to support hypotheses made by other investigators that interrelationships exist between cognitive, socio-personal and psychomotor factors in children of elementary school age. This was shown through interpretations of matrices and clusters in Chapter IV (pp. 74-122). There was supporting evidence that there were close relationships between specific components within an area (e.g., work study and academic composite with the cognitive area) and between two or more areas (e.g., height and arithmetic, within the anthropometric and academic areas).

An examination of data from the battery of tests revealed that educational achievement profiles on children grades 1-6 could be interpreted in several ways: by graphs, comparisons between ages and between sexes, percentage differences, increment and by class or individual subjects.

Normative data, described in Chapter IV (p. 63), could be used as a basis for comparison of growth and performance in academic achievement, socio-emotional behavior, physical growth and motor performance, according to age and sex. In analyzing the evidence of interrelationships among cognitive, socio-personal and psychomotor factors, it was found that the greatest positive significances, as discussed in "Intercorrelations," (Chapter IV, pp. 122-123) were within the anthropometric area (e.g., chest inspriation and chest expiration), and also the greatest negative significances were found within the anthropometric area (e.g., upper arm circumference and ponderal index). Highest positive significance between the academic and other areas were found accordingly:

v_1	(vocabulary)	and bone measurement
v_2	(reading)	and emotional stability
v_3	(language)	and motor performance
v_4	(work study)	and bone measurement
		and motor performance
		and emotional stability
v_5	(arithmetic)	and bone measurement
		and motor performance

In subjects studied by cluster analysis, Chapter IV (123-126), relationships were found within the area of anthropometric measurements, followed by relationships within the motor, academic and social areas. According to the same method, there were interrelationships between areas in the following order: (1) anthropometric-motor, (2) academic-motor, (3) socio-anthropometric-motor, (4) academic-social, (5) socio-motor, (6) socio-anthropometric, (7) academic-socio-motor and (8) academic-socio-anthropometric. There were no clusters in the academic-socio-anthropometric-motor area.

Normative data, intercorrelations and cluster analyses observed together relealed that:

1. There were some common clusterings throughout all age levels and with both sexes. For example, there were clusterings within the academic area and within the anthropometric area.
2. Clusters were noted which contained two or more areas among all age levels, with the exceptions of boys, age levels two and five, and girls, age level three.

The two preceding statements indicate that, because of certain interrelationships among all age groups and at certain age levels, placement of some classroom learning experiences and some physical education activities could be made in advance.

3. In boys, age groups two, six and eight, body size and motor performance related more than they did in other age groups. Relationships between body size and motor performance were observed in normative data, intercorrelation coefficients and in cluster analyses.
4. In boys, age groups except two and eight, clusters grouped the three skinfold measurements with pulse recovery rate. This could be interpreted as evidence of a relationship in boys between fat measures, exercise and heart condition.
5. Boys, age groups four, five, seven and eight added emotional stability to clusters on body build. It appeared that taller and larger boys were more sociable (clusters of boys, age groups two, five, seven and eight); whereas with girls, social acceptance tended to cluster more with academic performance, especially in girls, age levels five and seven.
6. Emotional stability tended to relate to body size and motor performance in boys, age groups two, four, five, seven and eight. In girls, emotional stability appeared to relate more to social approachability and to academic achievement.

With reference to preceding statements three, four, five and six, relationships existed between body size, motor performance and socio-emotional behavior. Social acceptance seemed to be associated with body structure in boys and with academic achievement in girls. Emotional stability tended to be assoicated with body size and motor performance in boys and to social behavior and academic achievement in girls. These observations might raise such questions as, "Do children's peer-acceptance standards change from developmental level to developmental level?"

7. In all academic areas, achievement increased with age level, with the exception of boys, age groups seven and eight. Similarly, there was an increase in height and weight measurements in both sexes in all age groups except boys, seven, and girls, six. This observation was noted in the normative data, correlation coefficients and cluster analyses.

This statement indicated a relationship between size, age and academic achievement, which supports the practice of academic expectations at various age levels, and the observation that physical growth tends to parallel chronological age. This observation could lead to questions as, "What kinds of relationships are there between physical stamina and academic performance?" Or, "What is the relationship between weight decrease and academic retrogression?" Or, "Are I.Q. tests erroneous because they fail to take into account the physical measures?"

8. In motor performance boys consistently scored higher than girls.

In reference to this statement, higher motor performance by boys as compared to girls, raises some important issues concerning programming. For example, "Are appropriate physical education activities provided for both boys and girls, or does the greater emphasis on sports and games for boys affect the program for girls even at the elementary level?" "Are differences in motor performance by boys and girls physiological or due to cultural patterns?"

Recommendations for Testing and Processing

For future testing and processing several recommendations are set forth based on observations made throughout the study. It is recommended that:

1. an in-service program be required for investigators (classroom teachers, special teachers, health services staff members and administrators who would be involved with testing programs). The purpose of this program would be to acquaint persons involved with merits and limitations of testing, methods and procedures of investigation, and use of results.

2. additional personnel be provided for test administration and recording of data through clerical services, by using high school students and parents, and by making more use of trained investigators. In a field program for college students, particpation in a research study would be mutually beneficial to students and to the school.
3. a research department with a director and staff be established by the public schools. Adequate professional and clerical personnel should be employed who would serve as liasions between computer centers, statistical departments, research laboratories and public school relations personnel. A research committee would aid in determining and implementing research goals of the public schools. Greater benefits would accrue through established lines of communication and therefore place less strain on school personnel who are not educated in research methods and techniques.
4. more time be spent in the selection of tests and instruments and test designs.
5. there be more involvement and additional services from the school district and the county for testing programs of this kind. For example, physicians

and nurses could have had a more active role in administering tests and in providing health services to the school (e.g., vision and hearing screening).

Recommendations for Further Study

On the basis of readings and findings from this study, it is recommended that certain aspects be studied in more depth. Such studies would include investigations:

1. to review early growth patterns in light of recent clinical research. For example, recent studies indicate a need to develop eye, hand and foot dominance in formative years, yet the physical education curriculum has placed sports (such as archery), which would help this development, much later in the curriculum. And, perhaps detrimentally to total development, curriculum activities have encouraged ambidertexity too soon.
2. to review enviromental factors which motivate growth, achievement and performance.
3. to discover the relationship between physical stamina and academic achievement.
4. to determine the physiological relationship between obesity, exercise and heart condition (in a longitudinal study design).
5. to discover and develop tests designed to measure specific capabilities of an individual at various

developmental levels, which can be administered and diagnosed within a reasonable period of time. Limited tests frequently mean limited program; therefore, an extension of testing would be designed with extended program in mind.

6. to redesign record profiles which would be more inclusive of all areas of growth, development and performance of individual pupils.
7. to determine designs for in-service programs on research, which would include test designs, the use of testing tools, test evaluation and test interpretation reflected in curriculum.
8. to explore community resources for team approaches for testing, diagnosing and prescribing appropriate activities for pupils. For example, if a test showed that the services of a neurologist were required, there should be such an expert available on the team. Other resources could be listed for testing and clerical help (such as, parents, high school students and college students).
9. to discern new patterns for the role of specialists
   a. as consultants to the classroom teacher
   b. as team members with diagnostic and prescriptive functions according to their specializations

14. to design, based on findings of environmental factors (number two), curriculum which would go beyond traditional classroom walls and traditional time "in school."

Recommendations Relating to Curriculum Improvement

There is considerable information in the study which has implications for curriculum improvement. Some of these recommendations could have immediate application, while others may require further study. In view of the testing and processes used and the evidence of interrelationships among cognitive, socio-personal and psychomotor factors, it is recommended that:

1. cooperative planning time be set aside for classroom teacher counseling with specialists. Curriculum planning would be based on test results and observations of pupils relative to common educational objectives.
2. interdisciplinary planning would be evaluated periodically in measuring curriculum improvement. This would enable specialists to complement and reinforce classroom activities.
3. provisions for counseling of children by classroom teachers and specialists be reflected in a guide for procedures and by time allotment in the schedule.

c. as curriculum planners

10. to design specific longitudinal comparative studies (experimental-control school design), centered around the hypothesis that carefully-selected full-time specialists make a difference in the development, motivation and achievement of pupils. Parallel studies could be made to determine values of curriculum integration.

11. to discover or design types of flexible scheduling which would permit

    a. teacher planning time between classroom teachers and specialists

    b. time for consultation between teachers, parents and pupils.

    c. use of specialists by classroom teachers as curriculum consultants.

12. to consider, on the basis of findings of growth patterns (number one), parallel activities by classroom teachers and specialists. For example, specific activities can be designed by the reading specialist and by the physical education teacher to enhance the establishment of bilaterality at the coritcal developmental level.

13. to give attention to the designing of curriculum for the individual pupil, which would include pupil needs and pupil objectives.

4. data from testing such as was done in the study be interpreted to classroom teachers and specialists so that they may be used appropriately by each group. For example, positive correlations between fat measures and pulse recovery rate would indicate that those responsible for health and physical education and the school and/or family physician should work closely with classroom teachers and parents. In so doing, the need for balanced diets and carefully planned programs for exercise and physical activity could be interpreted.

5. tests currently given in classrooms and physical education be re-evaluated in view of interrelationships found in the study. Consideration should be given to

   a. academic tests and physical fitness tests currently used, and their relationship to each other

   b. a continuous investigation of tests which predict learning readiness from observation of motor patterns

   c. other areas of motor performance such as lifetime skills (skiing, archery, angling and others) in view of their potential for educational achievement profiles. The

American Association for Health, Physical Education and Recreation is currently developing sports skills tests and norms which could be used in a comprehensive study of this type.

6. modifications in the curriculum and in instructional methods be determined with reference to motor skills, body build and temperament based on profiles established by this or similar studies. Some possible procedures leading to modifications might include

   a. analyzing the study for data that would have implications for programmed and individual learning. For example, certain children, because of body size and structure, find more success in certain types of activities. In turn, success is an important factor in the development of individual patterns of behavior.

   b. analyzing the study for implications pertaining to grouping in classrooms and special classes. For example, special and remedial activities should be provided for obese pupils to protect them from heart damage and at the same time reducing weight which would, in turn, help them acquire a faster pulse recovery rate.

7. the system of child records be reviewed in terms of type, use and interpretation in light of information concerning interrelationships.
8. ways be found to interpret to pupils and parents test results such as those determined in the study. For example, cumulative records could be kept on each child. These could include graphs, percentiles, stanines or whichever method seemed most appropriate. An overlay type of card could be designed with plotting equated to fit a similar pattern of growth or achievement. Mark-sensitized cards could be duplicated by IBM with one card remaining with school records and one card given to parents. (Explanation of marks could be printed on the back of the card).
9. in-service education programs be established which would stress integrated learning and which would sharpen observational powers of classroom teachers and specialists concerning interrelationships among cognitive, socio-personal and psychomotor factors.
10. in view of the experiences in Project "E" and in this study, the use of specialists, particulary in physical education and library services, be reviewed

by school administrators in view of the quality and quantity of such specialists needed within the school system.

11. the self-concept idea be explored further in practice (based upon what is already known), and in research as applied to physical education. For example, "What should a child understand about his physical being and about physical activity, and their effect on his performance?"

12. school systems design proposals for studies of child growth and development and their relationship to curriculum. Simultaneously, investigation should be made to find foundations or governmental agencies who would support such studies.

The realization that intellect, behavior and physique are related and inseparable parts of the human organism underlies newest thoughts about curriculum building and teaching methods. There is obviously a serious lag in many schools between what is known about the human organism and the learning process, and current educational practices. It is believed that this study contributed additional evidence about certain relationships among factors in children of elementary school age that are significant in developing a more effictive curriculum.

A research director in the public schools could hasten the process of both interpretation of the findings of such studies and encourage additional needed research. It is the hope of the writer that the educational profile of children, grades 1-6 herein presented and the accompanying recommendations may accelerate the development of educational programs consistent with the belief that whatever a child does, he does "all over."

APPENDICES

ITEM 1

MANUFACTURER'S LIST OF TESTING TOOLS

Item 1

Manufacturer's List of Testing Tools

Tool	Manufacturer
Skinfold Caliper	Cambridge Scientific Industries, Inc. Cambridge, Maryland
Circumference Tape (Metal 3/8" blade)	Lufkin Rule Co. Saginaw, Michigan
Bone Diameter Wooden Caliper	Lufkin Rule Co. Saginaw, Michigan
Hand Grip Dynamometer (kilograms)	Narragansett Machine Co. Providence, Rhode Island
Height-Weight Rule and Scales	Nissen-Medart Cedar Rapids, Iowa
Minerva Stopwatch (#140 Masker 1/10 sec.)	M. Ducommun Company 580 Fifth Avenue New York 36, New York
Softball (Regulation)	Wilson Sporting Goods Co. 2233 West Street River Grove, Illinois

ITEM 2

SA-S TEST

SA-S

JUNIOR SCALE

Patricia Carrigan and D. E. P. Smith
Bureau of Psychological Services
University of Michigan
1956

Item 2a

DIRECTIONS

Here are a lot of questions about your interests and your likes and dislikes. When you are told to start, you should begin with the first question. Read it carefully and answer it as truthfully as you can. Do the same with all the other questions. No one else will see your answers.

You do not have to write any words. Just read the questions and mark your answers on the answer sheet. Here are some samples.

Y. Are you
(a) a boy, or
(b) a girl?

Find Y on the answer sheet. If you are a boy, put an X in box a. If you are a girl, put an X in box b.

Z. Do you sometimes enjoy doing dangerous things?

Find Z on the answer sheet. If "Yes" tells how you feel about this, put an X in the box beside Yes. If not, put an X beside No.

Sometimes it will be hard to make up your mind between the two, but you can always find one answer that suits you a little better than the other. So never leave a question without marking one of the answers. As you see from these samples, there are no right and wrong answers. Each person is different and you only have to say what is true for you.

Do not spend a long time making up your mind. Mark the answer you think of first and go right on to the next question. When you have finished one page, just go right on to the next.

If there is anything you want to ask about what you have to do, ask now. If there is nothing now but later on you find a word you cannot read, stop and ask then. Be sure to mark one answer for every question.

1. When you have time to play, would you rather
   (a) find some friends to play with, or
   (b) paint or play with a puzzle by yourself?

2. Do you make up your mind quickly?

3. Do you know lots of children who are mean and don't play fair?

4. Which do you usually enjoy more?
   (a) working with others, or
   (b) working by yourself?

5. Harry, a boy in a story, knows his own ideas are good. He sticks to them even if other people say he's wrong. Are you like him?

6. Do you like everyone you know?

7. Is it more important to you
   (a) to have people like you, or
   (b) to get good marks?

8. When you have to make up your mind about something, would you rather
   (a) decide by yourself, or
   (b) find out what other people think before you decide?

9. Do you sometimes try to stay away from people because you just don't feel like talking?

10. When you grow up would you rather be
    (a) a newspaper reporter, or
    (b) a scientist?

11. Do you think the way you are used to doing things is usually better than new ways that people want you to try?

12. Would you tell a lie if it would keep you out of trouble?

13. During a vacation, would you rather
    (a) have fun with one or two good friends, or
    (b) go to a playground where there are lots of children, even if you didn't know many of them?

14. If your friends have different ideas from yours, do you
    (a) find it interesting to hear about them, or
    (b) try to make them see that your ideas are better?

15. Do you think you have as many friends as most children?

16. When something is very hard to do, do you usually like to
(a) work it out by yourself, or
(b) have a grown-up help you?

17. Would you be angry if a good friend played with something of yours without asking you?

18. Would you rather win a game than lose it?

19. Would you rather
(a) listen to someone who likes to tell interesting things, or
(b) study wild animals and birds?

20. If you were in a play with other children would you rather play the part of
(a) a school teacher, or
(b) a bold pirate?

21. When your friends want to do something different than you want to do, do you usually
(a) do what <u>you</u> want to do, or
(b) do what <u>they</u> want to do?

22. Do you think it's a good idea to take a chance on something even if it might not work out?

23. Is it more fun to
(a) play by yourself, or
(b) do things with other children?

24. If you could get into a movie without paying and without anyone finding out, would you do it?

25. At a picnic would you rather
(a) climb trees by yourself, or
(b) help the others get the food ready?

26. Do you try to get your own way even if you have to fight for it?

27. When something interesting happens to you, do you
(a) tell all your friends about it, or
(b) just think about how much fun it was?

28. Is it true that most of the gorwn-ups you know are very careful to be fair to children and to have no favorites?

29. On a rainy day at recess time would you rather
(a) show visitors around the school, or
(b) paint quietly by yourself?

30. Do you like to know some important people because it makes you feel important?

31. Would you say that you have
(a) many friends, or
(b) just a few friends?

32. When you are upset do you
(a) let other people know how you feel, or
(b) keep your feelings locked up inside yourself?

33. Which do you enjoy more?
(a) just working and playing along with other boys and girls, or
(b) trying hard to show you can beat everyone at something?

34. Do you think that people understand and like you?

35. Would you rather spend free time
(a) by yourself, with a book or stamp collection, or
(b) in a lively game with several people?

36. Would you be happier if people liked you better?

37. Do you think a lot and say very little?

38. When you are with a group of children, do you usually
(a) do what you think is best, even if the others don't agree, or
(b) do what the other children want to do?

39. Have you ever helped to start a club, a team or a group?

40. When you visit a new city would you rather
(a) be shown around by someone who knows so that you see the right things, or
(b) walk around by yourself, doing as you please?

41. In school would you rather
(a) work on something all by yourself, or
(b) work in a group with other children?

42. Have you ever said unkind things about people when they were not around?

43. Do you think most people would be honest and obey the rules even if there were no danger of being caught cheating?

44. When your friends quarrel, do you think it is better to
    (a) try to get them to talk it over, or
    (b) leave them to work it out for themselves?

45. Do you often wish other people would leave you alone and not bother you?

46. If you were having fun playing a game by yourself, would you
    (a) finish it, even if your friends wanted you to play with them, or
    (b) put it away and play with your friends?

47. If you found some money when no one was around, would you like to keep it?

48. Do you sometimes feel very unhappy without knowing why?

49. Do you often feel quite tired when you get up in the morning?

50. Are you often upset when something happens so that you cannot do what you had planned to do?

51. Do you often find yourself thinking of other things when your teacher is talking?

52. Do you often have bad dreams?

53. Have you ever wanted to get even with someone who was mean to you?

54. Do you sometimes worry and get excited when you think back over things that happened during the day?

55. Do your teachers, or people at home, sometimes scold you when you've done nothing wrong?

56. When you have something very important to do, do you sometimes get so upset that you can't do it?

57. Do you think you have more troubles than most people?

58. When you are walking on a quiet street after dark, are you sometimes afraid you are being followed?

59. Do you get angry sometimes?

60. If someone asks you to do a new and hard job, do you usually
(a) feel glad to have a chance to try, or
(b) feel frightened and want to let someone else do it?

61. Do you think a lot about mistakes you have made?

62. Warren, a boy in a story, sometimes feels quite scared. He even shakes a little or sweats without any reason for being afraid. Do you sometimes feel like him?

63. Do you sometimes wish you did not worry so much about your school work?

64. Do you sometimes wake up at night and begin worrying, so that it is hard to go back to sleep?

65. Once in a while do you think of things too bad to talk about?

66. Do you have times when you cannot help feeling sorry for yourself?

67. Is it hard for you to make up your mind about things?

68. Do you feel cross and upset if someone does better at something than you can do?

69. Is it hard for you to talk in front of a large group of people?

70. Do you sometimes worry about little things even though you know they are not important?

71. Do you sometimes feel so nervous that sudden noises make you jump and a screechy door gives you the shivers?

72. Sometimes when you're not feeling well, are you cross?

73. Do you feel you are getting along well and that you get over your troubles pretty easily?

74. Do your feelings change so quickly that you feel happy for one hour and sad the next hour?

75. Is it hard for you to fall asleep at night?

76. When little things go wrong, do you
(a) just laugh, or
(b) get cross or upset?

77. Do people say that you day-dream?

78. Do you sometimes feel you are not much good becuase very few things work out right for you?

79. Do you sometimes put off doing things that you ought to do?

80. Do you get a bit scared in the dark or when you look down from a high place?

81. Are you upset if you suddenly find everyone looking at you?

82. Have you ever felt afraid all of a sudden without any reason?

83. Do you always tell the truth?

84. Do you often feel that you cannot do things as well as most people?

Item 2b

SA-S EXPLANATION SHEET

Background

The SA-S Scales are questionnaires for determining two aspects of personality important to success in school and in other achievement situations. The first scale, SA (social approach), appears to reflect sociability while the second, S (stability) consists of items usually associated with presence or absence of excessive fears, worries and anxieties.

Explanation

The two dimensions sampled by the scales are "permeability" and "anxiety". Permeability (SA) includes sensitivity to the external environment, especially in social relationship, and the amount of communication among psychic systems, greater communication implying imagination, capacity for substitute behaviors when the goal is blocked, and perhaps ideation fluency.

Anxiety (S) is defined as a continuous state of tension sufficiently greater than normal so that behavior is adversely affected.

Item 2c

Name___________________________ Age____________ Grade______________

Samples: Y. ___a ___b

Z. ___Yes ___No

SA-S JUNIOR SCALE

1.	___a ___b	29.	___a ___b	57.	___Yes ___No
2.	___Yes ___No	30.	___Yes ___No	58.	___Yes ___No
3.	___Yes ___No	31.	___a ___b	59.	___Yes ___No
4.	___a ___b	32.	___a ___b	60.	___a ___b
5.	___Yes ___No	33.	___a ___b	61.	___Yes ___No
6.	___Yes ___No	34.	___Yes ___No	62.	___Yes ___No
7.	___a ___b	35.	___a ___b	63.	___Yes ___No
8.	___a ___b	36.	___Yes ___No	64.	___Yes ___No
9.	___Yes ___No	37.	___Yes ___No	65.	___Yes ___No
10.	___a ___b	38.	___a ___b	66.	___Yes ___No
11.	___Yes ___No	39.	___Yes ___No	67.	___Yes ___No
12.	___Yes ___No	40.	___a ___b	68.	___Yes ___No
13.	___a ___b	41.	___a ___b	69.	___Yes ___No
14.	___a ___b	42.	___Yes ___No	70.	___Yes ___No
15.	___Yes ___No	43.	___Yes ___No	71.	___Yes ___No
16.	___a ___b	44.	___a ___b	72.	___Yes ___No
17.	___Yes ___No	45.	___Yes ___No	73.	___Yes ___No
18.	___Yes ___No	46.	___a ___b	74.	___Yes ___No
19.	___a ___b	47.	___Yes ___No	75.	___Yes ___No
20.	___a ___b	48.	___Yes ___No	76.	___a ___b
21.	___a ___b	49.	___Yes ___No	77.	___Yes ___No
22.	___Yes ___No	50.	___Yes ___No	78.	___Yes ___No
23.	___a ___b	51.	___Yes ___No	79.	___Yes ___No
24.	___Yes ___No	52.	___Yes ___No	80.	___Yes ___No
25.	___a ___b	53.	___Yes ___No	81.	___Yes ___No
26.	___Yes ___No	54.	___Yes ___No	82.	___Yes ___No
27.	___a ___b	55.	___Yes ___No	83.	___Yes ___No
28.	___Yes ___No	56.	___Yes ___No	84.	___Yes ___No

Item 2d

TEACHER SUBJECTIVE RATING
SA-S TEST

Background

The SA-S Scales are questionnaires for determining two aspects of personality important to success in school and in other achievement situations. The first scale, SA (social approach), appears to reflect sociability while the second, S (stability) consists of items usually associated with presence or absence of excessive fears, worries, and anxieties.

Explanation

The two dimensions sampled by the scales are "permeability" and "anxiety." Permeability (SA) includes sensitivity to the external environment, especially in social relationship, and the amount of communication among psychic systems, greater communication implying imagination, capacity for substitute behaviors when the goal is blocked, and perhaps ideation fluency.

Anxiety (S) is defined as a continuous state of tension sufficiently greater than normal so that behavior is adversely affected.

Personality Rating Scales

The teacher is to pull out from the class the code numbers of the most permeable 20% and the most impermeable 20% and rate these 40% on the "SA" scale from 1-5 (or between if necessary).

		5	4	3	2	1	
SA	Permeable	|	|	|	|	|	Impermeable

(flexible, social erratic, tend to skim surface of life, talkative)

(conservative, fixed asocial, quite conscientious, reserved, methodical, serious, individualistic)

The teacher is to pull out from the class the code numbers of the most stable 20% and the most anxious 20% and rate these 40% on the "S" scale from 1-5 or (between if necessary).

		5	4	3	2	1	
S	Stable						Anxious

(mature, ability to concentrate and memorize, over-achiever, self-confident, free from excessive anxiety, emotionally responsive)

(rigid, withdrawn, follows a strong leader, dislikes discussions, over-organized, exam panic, apt to regress and behave immaturely)

Item 2e

School____________________________Teacher________________________

Grade____________________________

<u>Personality Rating Scale</u> (Reliability Test)

1. 20% Most Permeable — 20% Most Impermeable (Least Permeable)

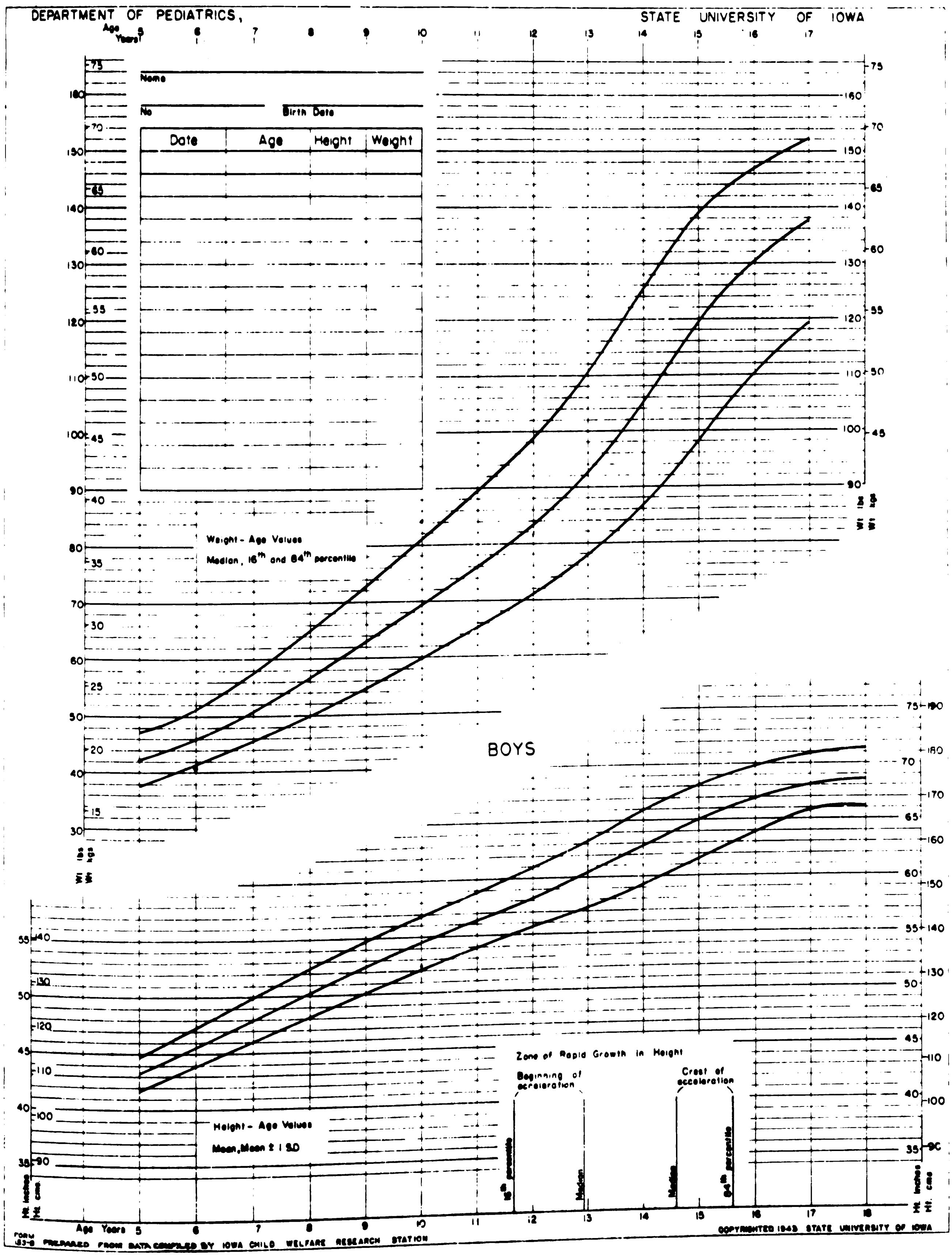
Code Number	Scale Rating	Code Number	Scale Rating

2. 20% Most Stable — 20% Most Anxious (Least Stable)

Code Number	Scale Rating	Code Number	Scale Rating

ITEM 3

IOWA NORMS


DEPARTMENT OF PEDIATRICS,
STATE UNIVERSITY OF IOWA
Age Years
Name
No
Birth Date
Date
Age
Height
Weight
Weight - Age Values
Median, 16th and 84th percentile
BOYS
Wt lbs
Wt kgs
Height - Age Values
Mean, Mean ± 1 S.D.
Zone of Rapid Growth in Height
Beginning of acceleration
Crest of acceleration
16th percentile
Median
Median
84th percentile
Ht. inches
Ht. cms
Age Years
FORM 153-B PREPARED FROM DATA COMPILED BY IOWA CHILD WELFARE RESEARCH STATION
COPYRIGHTED 1943 STATE UNIVERSITY OF IOWA

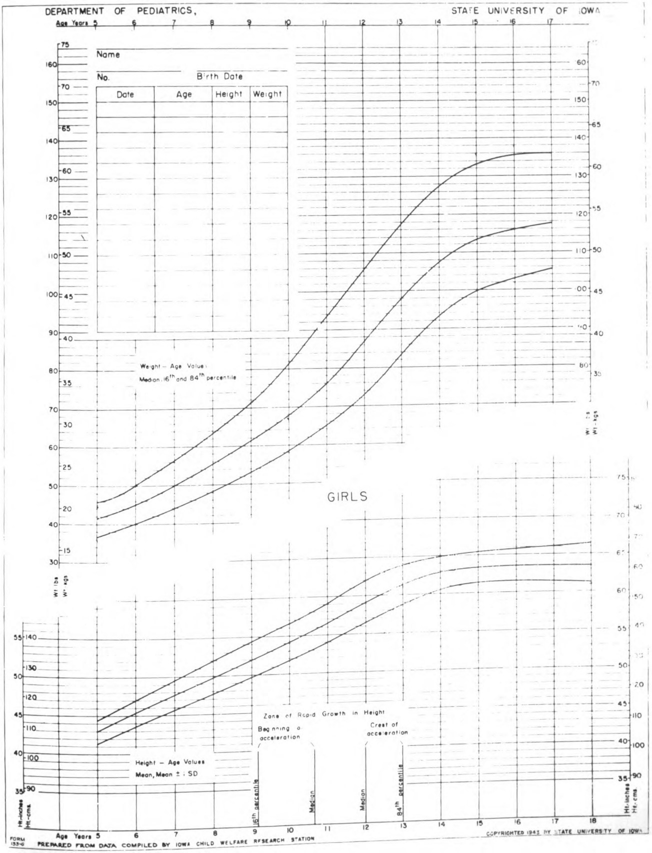

DEPARTMENT OF PEDIATRICS,
STATE UNIVERSITY OF IOWA
Age Years
Name
No.
Birth Date
Date
Age
Height
Weight
Weight - Age Values
Median, 16th and 84th percentile
GIRLS
Zone of Rapid Growth in Height
Beginning of acceleration
Crest of acceleration
16th percentile
Median
Median
84th percentile
Height - Age Values
Mean, Mean ± 1 SD
Wt lbs
Wt kgs
Ht-inches
Ht-cms.
FORM 133-G
PREPARED FROM DATA COMPILED BY IOWA CHILD WELFARE RESEARCH STATION
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Table 6.1.--Standard Weight Tables for Boys.

Age Yr.	Mo.	Standard Wt. (Lb.)	Age Yr.	Mo.	Standard Wt. (Lb.)	Age Yr.	Mo.	Standard Wt. (Lb.)
5	0	42	6	9	50	8	6	60
5	1	42	6	10	50	8	7	61
5	2	43	6	11	51	8	8	61
5	3	43	7	0	51	8	9	62
5	4	44	7	1	52	8	10	62
5	5	44	7	2	52	8	11	63
5	6	44	7	3	53	9	0	63
5	7	44	7	4	53	9	1	64
5	8	45	7	5	54	9	2	64
5	9	45	7	6	54	9	3	65
5	10	45	7	7	55	9	4	65
5	11	46	7	8	55	9	5	66
6	0	46	7	9	56	9	6	67
6	1	46	7	10	56	9	7	67
6	2	47	7	11	57	9	8	68
6	3	47	8	0	57	9	9	68
6	4	48	8	1	58	9	10	69
6	5	48	8	2	58	9	11	70
6	6	48	8	3	59	10	0	70
6	7	49	8	4	59	10	1	71
6	8	49	8	5	60	10	2	71

Table 6.1.--Continued

Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)
10 3	72	12 0	83	13 9	102
10 4	72	12 1	84	13 10	103
10 5	73	12 2	85	13 11	104
10 6	73	12 3	85	14 0	105
10 7	74	12 4	86	14 1	106
10 8	74	12 5	87	14 2	108
10 9	75	12 6	88	14 3	109
10 10	75	12 7	89	14 4	110
10 11	76	12 8	89	14 5	112
11 0	76	12 9	90	14 6	113
11 1	77	12 10	91	14 7	114
11 2	77	12 11	92	14 8	115
11 3	78	13 0	93	14 9	117
11 4	78	13 1	94	14 10	118
11 5	78	13 2	95	14 11	119
11 6	80	13 3	96	15 0	120
11 7	80	13 4	97	15 1	121
11 8	81	13 5	98	15 2	122
11 9	81	13 6	99	15 3	122
11 10	82	13 7	100	15 4	123
11 11	83	13 8	101	15 5	124

Table 6.1.--Continued

Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)
15 6	125	16 0	130	16 6	134
15 7	126	16 1	131	16 7	135
15 8	126	16 2	131	16 8	135
15 9	127	16 3	132	16 9	136
15 10	128	16 4	133	16 10	137
15 11	129	16 5	133	16 11	137
				17 0	138

Table 6.1.--Standard Weight Table for Girls.

Age Yr.	Age Mo.	Standard Wt. (Lb.)	Age Yr.	Age Mo.	Standard Wt. (Lb.)	Age Yr.	Age Mo.	Standard Wt. (Lb.)
5	0	42	6	10	49	8	8	59
5	1	42	6	11	50	8	9	60
5	2	42	7	0	50	8	10	60
5	3	43	7	1	51	8	11	61
5	4	43	7	2	51	9	0	61
5	5	43	7	3	52	9	2	62
5	6	44	7	4	52	9	3	63
5	7	44	7	5	52	9	4	63
5	8	44	7	6	53	9	5	64
5	9	44	7	7	53	9	6	65
5	10	45	7	8	53	9	7	65
5	11	45	7	9	54	9	8	65
6	0	45	7	10	54	9	9	66
6	1	46	7	11	55	9	10	67
6	2	46	8	0	55	9	11	68
6	3	47	8	1	56	10	0	68
6	4	47	8	2	56	10	1	69
6	5	47	8	3	57	10	2	69
6	6	48	8	4	57	10	3	70
6	7	48	8	5	58	10	4	71
6	8	48	8	6	58	10	5	71
6	9	49	8	7	59	10	6	72

Table 6.1.--Continued

Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)
10 7	73	12 6	92	14 6	110
10 8	73	12 7	93	14 7	111
10 9	74	12 8	94	14 8	111
10 10	75	12 9	95	14 9	112
10 11	75	12 10	96	14 10	112
11 0	76	12 11	97	14 11	113
11 1	77	13 0	98	15 0	113
11 2	78	13 2	100	15 1	113
11 3	79	13 3	100	15 2	113
11 4	80	13 4	101	15 3	114
11 5	80	13 5	102	15 4	114
11 6	81	13 6	103	15 5	114
11 7	82	13 7	103	15 6	115
11 8	83	13 8	104	15 7	115
11 9	84	13 9	105	15 8	115
11 10	85	13 10	106	15 9	115
11 11	86	13 11	106	15 10	116
12 0	87	14 0	107	15 11	116
12 1	88	14 1	108	16 0	116
12 2	89	14 2	108	16 1	116
12 3	90	14 3	109	16 2	116
12 4	91	14 4	109	16 3	116
12 5	91	14 5	114	16 4	117

Table 6.1.--Continued

Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)	Age Yr. Mo.	Standard Wt. (Lb.)
16 5	117	16 8	117	16 11	118
16 6	117	16 9	118	17 0	118
16 7	117	16 10	118		

Item 3b.

Table 6.1.--Standard Height Tables for Boys.

Age Yr.	Age Mo.	Standard Ht. (In.)	Age Yr.	Age Mo.	Standard Ht. (In.)	Age Yr.	Age Mo.	Standard Ht. (In.)
5	0	43.5	6	8	47.0	8	4	51.0
5	1	43.5	6	9	47.5	8	5	51.0
5	2	44.0	6	10	47.5	8	6	51.0
5	3	44.0	6	11	48.0	8	7	51.5
5	4	44.0	7	0	48.0	8	8	51.5
5	5	44.0	7	1	48.0	8	9	52.0
5	6	44.5	7	2	48.5	8	10	52.0
5	7	44.5	7	3	48.5	8	11	52.5
5	8	44.5	7	4	48.5	9	0	52.5
5	9	45.0	7	5	48.5	9	1	52.5
5	10	45.0	7	6	49.0	9	2	53.0
5	11	45.5	7	7	49.0	9	3	53.0
6	0	45.5	7	8	49.0	9	4	53.0
6	1	45.5	7	9	49.5	9	5	53.0
6	2	46.0	7	10	49.5	9	6	53.5
6	3	46.0	7	11	50.0	9	7	53.5
6	4	46.5	8	0	50.0	9	8	53.5
6	5	46.5	8	1	50.0	9	9	54.0
6	6	46.5	8	2	50.5	9	10	54.0
6	7	47.0	8	3	50.5	9	11	54.5

Table 6.1.--Continued

Age Yr. Mo.	Standard Ht. (in.)	Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)
10 0	54.5	11 10	57.5	13 8	62.0
10 1	54.5	11 11	58.0	13 9	62.5
10 2	55.0	12 0	58.0	13 10	62.5
10 3	55.0	12 1	58.0	13 11	63.0
10 4	55.0	12 2	58.5	14 0	63.0
10 5	55.0	12 3	58.5	14 1	63.0
10 6	55.5	12 4	59.0	14 2	63.5
10 7	55.5	12 5	59.0	14 3	63.5
10 8	55.5	12 6	59.0	14 4	63.5
10 9	55.5	12 7	59.5	14 5	63.5
10 10	56.0	12 8	59.5	14 6	64.0
10 11	56.0	12 9	60.0	14 7	64.0
11 0	56.0	12 10	60.0	14 8	64.0
11 1	56.0	12 11	60.5	14 9	64.5
11 2	56.5	13 0	60.5	14 10	64.5
11 3	56.5	13 1	60.5	14 11	65.0
11 4	56.5	13 2	61.0	15 0	65.0
11 5	56.5	13 3	61.0	15 1	65.0
11 6	57.0	13 4	61.5	15 2	65.0
11 7	57.0	13 5	61.5	15 3	65.5
11 8	57.0	13 6	61.5	15 4	65.5
11 9	57.5	13 7	62.0	15 5	65.5

Table 6.1--Continued

Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)
15 6	66.0	16 0	67.0	16 6	67.5
15 7	66.0	16 1	67.0	16 7	67.5
15 8	66.0	16 2	67.0	16 8	67.5
15 9	66.5	16 3	67.0	16 9	67.5
15 10	66.5	16 4	67.5	16 10	68.0
15 11	67.0	16 5	67.5	16 11	68.0
				17 0	68.0

Table 6.1.--Standard Height Tables for Girls.

Age Yr.	Mo.	Standard Ht. (In.)	Age Yr.	Mo.	Standard Ht. (In.)	Age Yr.	Mo.	Standard Ht. (In.)
5	0	43.0	6	9	47.0	8	6	50.5
5	1	43.0	6	10	47.0	8	7	51.0
5	2	43.5	6	11	47.5	8	8	51.0
5	3	43.5	7	0	47.5	8	9	51.5
5	4	44.0	7	1	47.5	8	10	51.5
5	5	44.0	7	2	48.0	8	11	52.0
5	6	44.0	7	3	48.0	9	0	52.0
5	7	44.5	7	4	48.0	9	1	52.0
5	8	44.5	7	5	48.0	9	2	52.5
5	9	45.0	7	6	48.5	9	3	52.5
5	10	45.0	7	7	48.5	9	4	52.5
5	11	45.5	7	8	48.5	9	5	52.5
6	0	45.5	7	9	49.0	9	6	53.0
6	1	45.5	7	10	49.0	9	7	53.0
6	2	46.0	7	11	49.5	9	8	53.0
6	3	46.0	8	0	49.5	9	9	53.5
6	4	46.0	8	1	49.5	9	10	53.5
6	5	46.0	8	2	50.0	9	11	54.0
6	6	46.5	8	3	50.0	10	0	54.0
6	7	46.5	8	4	50.5	10	1	54.0
6	8	46.5	8	5	50.5	10	2	54.5

Table 6.1.--Continued

Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)
10 3	54.5	12 0	59.0	13 9	62.5
10 4	55.0	12 1	59.5	13 10	62.5
10 5	55.0	12 2	59.5	13 11	63.0
10 6	55.0	12 3	59.5	14 0	63.0
10 7	55.5	12 4	59.5	14 1	63.0
10 8	55.5	12 5	59.5	14 2	63.0
10 9	56.0	12 6	60.0	14 3	63.0
10 10	56.0	12 7	60.0	14 4	63.0
10 11	56.5	12 8	60.0	14 5	63.0
11 0	56.5	12 9	60.5	14 6	63.0
11 1	56.5	12 10	60.5	14 7	63.0
11 2	57.0	12 11	61.0	14 8	63.5
11 3	57.0	13 0	61.0	14 9	63.5
11 4	57.5	13 1	61.0	14 10	63.5
11 5	57.5	13 2	61.5	14 11	63.5
11 6	57.5	13 3	61.5	15 0	63.5
11 7	58.0	13 4	61.5	15 1	63.5
11 8	58.0	13 5	61.5	15 2	63.5
11 9	58.5	13 6	62.0	15 3	63.5
11 10	59.0	13 7	62.0	15 4	63.5
11 11	59.0	13 8	62.0	15 5	63.5

Table 6.1.--Continued

Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)	Age Yr. Mo.	Standard Ht. (In.)
15 6	63.5	16 0	63.5	16 6	63.5
15 7	63.5	16 1	63.5	16 7	63.5
15 8	63.5	16 2	63.5	16 8	63.5
15 9	63.5	16 3	63.5	16 9	63.5
15 10	63.5	16 4	63.5	16 10	63.5
15 11	63.5	16 5	63.5	16 11	63.5
				17 0	63.5

Item 3c.

Table 6.2.--Tables for Age Groups

	11	12	13	14	Age in years		Columns 11	12	13	14	Age in years
Age Group 1	0	9	5	8	5	Age Group 4	0	9	5	5	8
	1	0	5	8	5		1	0	5	5	8
	1	1	5	8	5		1	1	5	5	8
	1	2	5	8	5		1	2	5	5	8
	0	1	5	7	5		0	1	5	4	8
	0	2	5	7	5		0	2	5	4	8
	0	3	5	7	5		0	3	5	4	8
	0	4	5	7	5		0	4	5	4	8
	0	5	5	7	5		0	5	5	4	8
	0	6	5	7	5		0	6	5	4	8
	0	7	5	7	5		0	7	5	4	8
	0	8	5	7	5		0	8	5	4	8
Age Group 2	0	9	5	7	6	Age Group 5	0	9	5	4	9
	1	0	5	7	6		1	0	5	4	9
	1	1	5	7	6		1	1	5	4	9
	1	2	5	7	6		1	2	5	4	9
	0	1	5	6	6		0	1	5	3	9
	0	2	5	6	6		0	2	5	3	9
	0	3	5	6	6		0	3	5	3	9
	0	4	5	6	6		0	4	5	3	9
	0	5	5	6	6		0	5	5	3	9
	0	6	5	6	6		0	6	5	3	9
	0	7	5	6	6		0	7	5	3	9
	0	8	5	6	6		0	8	5	3	9
Age Group 3	0	9	5	6	7	Age Group 6	0	9	5	3	10
	1	0	5	6	7		1	0	5	3	10
	1	1	5	6	7		1	1	5	3	10
	1	2	5	6	7		1	2	5	3	10
	0	1	5	5	7		0	1	5	2	10
	0	2	5	5	7		0	2	5	2	10
	0	3	5	5	7		0	3	5	2	10
	0	4	5	5	7		0	4	5	2	10
	0	5	5	5	7		0	5	5	2	10
	0	6	5	5	7		0	6	5	2	10
	0	7	5	5	7		0	7	5	2	10
	0	8	5	5	7		0	8	5	2	10

Table 6.2.--Continued

	Columns 11	12	13	14	Age in years		Columns 11	12	13	14	Age in years
Age Group 7	0	9	5	2	11	Age Group 8	0	9	5	1	12
	1	0	5	2	11		1	0	5	1	12
	1	1	5	2	11		1	1	5	1	12
	1	2	5	2	11		1	2	5	1	12
	0	1	5	1	11		0	1	5	0	12
	0	2	5	1	11		0	2	5	0	12
	0	3	5	1	11		0	3	5	0	12
	0	4	5	1	11		0	4	5	0	12
	0	5	5	1	11		0	5	5	0	12
	0	6	5	1	11		0	6	5	0	12
	0	7	5	1	11		0	7	5	0	12
	0	8	5	1	11		0	8	5	0	12

ITEM 4

PROJECT "E" TEST MANUAL: ADMINISTRATIVE INSTRUCTIONS FOR TESTING PROGRAM, PHYSICAL PERFORMANCE TESTS

Item 4

ADMINISTRATIVE INSTRUCTIONS FOR TESTING PROGRAM

I. CARDIOVASCULAR FITNESS

<u>Two-Minute Step Test</u> (Blue) - (Cafeteria Alcove)

<u>Personnel Required</u>

One tester and 24 tester-recorders

<u>Maximum Number of Participants</u> - 24

<u>Anticipated Time per Person</u> - 6 minutes

<u>Equipment</u>

(1) 1 stop watch; (2) 1 tape recorder and tape; (3) 2 step-test benches; (4) 1 table; (5) clipboards; (6) 3 doz. blue pencils

<u>Instructions to Tester</u>

The pulse rate may be taken at either the brachial artery or the carotid artery. The brachial is generally more easily found in the resting state and the carotid after exercise.

Subjects will step for two minutes at 30 steps per minute followed by one minute rest in the sitting position. Pulse will be taken in the sitting position between 1 minute to 1 minute, 30 seconds after stepping. Room temperature should be between 65! and 78!

The taped music will be set at 120 steps per minute.

With first and second graders and others who need it, the tester should accompany the subjects as they perform the test. You may also call out; "UP, UP, DOWN, ONE! UP, UP, DOWN, TWO!" to assist the subject's timing.

Immediately upon completion of the two-minute test period, make sure the subject sits down on the bench. Using the stop watch, allow one-minute rest. At the end of the one-minute rest, place your first two fingers over the carotid artery and pick up the pulse rate from one minute to one minute, 30 seconds after the end of the stepping.

Read the following instructions through, then ask for questions. Do not give any other words of instruction or words of encouragement.

Test Instructions

> I will read the instructions once. Listen carefully. You may ask questions after this is read. This is a test to find out how much you can do without getting tired. You will stand in front of the bench and listen to the beat of the music. When I say "GO" you will step up with either your right or your left foot on the first beat of the music, then up with the other foot on the second beat so you will be standing on the bench (DEMONSTRATE WHILE TALKING). Now you will step down with the first foot on the third beat, then down with the other foot on the fourth beat. When I say "STOP", sit down on the bench and do not move until I tell you. Then we will take your pulse (DEMONSTRATE). Are there questions?. . .You may now practice. Stand in front of the bench. Ready, "GO!". . .Ready, "STOP". . .Are there questions? . . .Now we will begin the real test. Ready, "GO". . .Ready, "STOP". "SIT DOWN".

Scoring

Recovery pulse rate in beats per minute. Record this in blue pencil for the pre-test results in October 1963 and red pencil for the post-test results in the spring of 1964.

II. GRIP STRENGTH

Hand Dynamometer Test (White) - (Storage Room off Multi-purpose Room)

Personnel Required - 6 tester-recorders

Maximum Number of Participants - 6

Anticipated Time per Person - 3 minutes

Equipment

(1) 6 rectangular-type grip dynamometer measured in kilograms; (2) 6 dry towels; (3) if warm weather, cake of magnesium carbonate; (4) 1 table; (5) 1 chair; (6) 9 blue pencils

Instructions to Tester

The adjustment of the hand dynamometer to the individual child is particularly important. Read the following instructions to the child while you demonstrate the correct positioning to enable a correct adjustment to be made:

> One edge of the grip dynamometer is curved upward at the end. This edge should be placed against the fingers and the more rounded edge against the base of the hand. The indicator should be toward the palm, as the fingers are apt to interfere with the movement of the indicator. The outer edge

of the dynamometer is placed between the first and second joints of the fingers.

Place the dynamometer in the subject's hand and assure correct adjustments are made. Once this has been completed, read the following test instructions through once and then ask for any questions. Do not give any other words of instruction or words of encouragement.

Test Instructions

This dynamometer (HOLD ALOFT) is used to tell how hard you can squeeze. You will have two tries for each hand, and we will use the bigger score. You must stand, and you hand, arm or fingers may not touch your body or anything else (DEMONSTRATE). Put the dynamometer in your right hand and on the word, "GO", squeeze as hard as you are able without jerking. Any questions?. . .Put the dynamometer in your right hand (CHECK FOR RIGHT HAND) . . .Ready, "GO". . .Second try for your right hand; Ready, "GO". . . Now put the dynamometer in your left hand. . .Ready, "GO". . .Second try. . . Ready, "GO". . .

Scoring

Read each score aloud and record both scores in kilograms for each hand. Record the pre-test results in blue pencil in October 1963 and the post-test results in red pencil in the spring of 1964.

III. SPEED

40-Yard Dash (Green) - (Playground)

Personnel Required

4 timer-recorders; 1 starter; 1 restrainer

Maximum Number of Participants - 4

Anticipated Time per Person - 4 minutes

Equipment

(1) Four stop watches measuring tenths of a second; (2) Four 45-yard straightaways with hashmark at 40 yards (outdoor grassy area); (3) starting flag; (4) 6 blue pencils

Instructions to Tester

This is a test of speed. Subjects will have two trials with the better time recorded. Allow a minimum of five minutes between the first and second trial. The end line of the straightaway will be 45 yards away from the starting line. Hashmarks will be placed 40 yards from the starting line to locate the timer's position. This is to encourage the subjects to run as fast as they are able the full 40 yards without slowing down as they approach the finish line. During the instruction, place the timers at the 45-yard finish line while you stand in front of the starting line with the flag in your hand.

Read the instructions once only and then ask for any questions. Do not give any other words of instruction or words of encouragement. Line up no more than 6 subjects behind the starting line of each line of each straightaway and instruct all at one time.

Test Instructions

You will be timed for your speed for the 40-yard dash. You will begin at this while starting line (POINT) and run as fast as you are able to the while finish line at the end of the straightaway where the timers are pointing (RAISE HANDS, THEN POINT). Do not slow down until you have passed over that white line. You will get two tries with your better time recorded. When you finish the first try, return to the starting line (POINT) for your race and stand behind the other children.

You may start in a crouched position but your hands must not touch the ground. (TESTER DEMONSTRATES PERMISSIBLE STARTING POSITIONS.) I will raise the starting flag in the air, saying: "READY", and saying "GO" as I drop the starting flag downward as a signal to the timers. You will start on the word, "GO!" Your time will not be counted if you start before the word "GO".

The first runners in each lane should take their starting postions behind the starting line. . . "READY", "GO!"

Instructions to Timers

You will stand at the 45-yard finish line while the instructions are read to the subject and remain there until after the "GO" signal. Then you take your place at the hashmarks at 40 yards. <u>You must offer no words of encouragement to the subjects</u>.

Start your watch as the starting flag starts its downward sweep. Stop the watch the moment the subject crosses the finish line.

Scoring

The score shall be recorded by the timers in seconds and tenths of seconds. Record the pre-test results in blue pencil in October 1963 and the post-test results in red pencil in the spring of 1964.

IV. EXPLOSIVE LEG POWER

Broad Jump (Red) - (Multipurpose Room Between Exit Doors)

Personnel Required - 4 tester-recorders

Maximum Number of Participants - 4

Anticipated Time per Person - 3 minutes

Equipment

(1) 8 tape-measured tumbling mats; (2) 4 take-off boards; (3) clip boards; (4) 1 doz. blue pencils; (5) 4 yardsticks; (6) 4 magic markers; (7) extra tape.

Instructions to Tester

This is a test of explosive power. Line up no more than six subjects and read the instructions to all at the same time. Read the instructions once, than ask for questions. Do not give any other words of instruction or words of encouragement.

Test Instructions

This is a test to see how far you can jump from the standing position. You will stand with your feet several inches apart (DEMONSTRATE) and with your toes just back of the edge of the board. Use both feet to jump forward as far as you are able, landing on both feet. You may bend your knees (DEMONSTRATE) and swing your arms to help give you some lift (DEMONSTRATE) but your feet must not leave the board until the jump is made. You will be given two tries with the better jump scored. There will be no starting signal - jump when you are in the correct starting position and ready to go. When you are finished with your first jump, go back to the board for your second try. I will now demonstrate. . .Now, the first person in each row step forward onto the take-off board and jump when you are ready.

Scoring

Two fair trials (not including fouls) shall be allowed. The subject's jumps should be recorded in inches to the nearest inch.

V. AGILITY

Side Stepping (Yellow) - (Multipurpose Room - Center Area)

Personnel Required - 1 tester-timer; 12 tester-recorders

Maximum Number of Participants - 12

Anticipated Time per Person - 3 minutes

Equipment

(1) Taped floor (for 12 stations); (2) clip boards; (3) 1 1/2 dz. blue pencils; (4) 1 stop watch; (5) extra tape

Instructions to Tester (Timer)

This is a general test of agility and is surprisingly good for predicting scores and skills potentiality. Have the subjects stand outside the middle at each station. Read the instructions once, then ask for questions. Allow 30 seconds for practice with the recorders at the stations assisting their subjects. Only one trial will be given. Do not give any other words of instruction or words of encouragement.

Test Instructions

This is a test to see how quickly you move. You should stand straddling (DEMONSTRATE) the middle line with one foot on either side. At the signal you will side-step to the right (POINT) until your right foot touches the line to your right. You then side step to the left until your left foot touches the line to your left (DEMONSTRATE). (The object is to see how many times you can touch each outside line (POINT) going from one side to the other). In moving back and forth you may step on the middle line but to score a point your foot must touch the lines on your right and left. The words to begin will be READY, GO! Look at me (DEMONSTRATE). Now, you may practice. READY, GO!. . .

The practice period is now over. Please straddle the middle line and listen for the starting words. Remember, side-step as fast as you can. . .Ready! GO!

Scoring

One point is scored each time the subject touches his right foot outside the right line, when he touches his foot outside the left line, and when he comes over the middle line on the way right and left. Begin counting the first time his right or left foot touches the line on the right or left, only when his foot touches entirely outside the line. Record the pre-test results in blue pencil in October 1963 and the post-test results in red pencil in the spring of 1964.

VI. THROW FOR DISTANCE

Softball Throw (Brown) - (Playground)

Maximum Number of Participants - 4

Anticipated Time per Person - 6 minutes

Equipment

(1) Field line to measure feet; (2) 5 different colored beanbags; (3) 2 dz. 8-inch softballs; (4) 4 50-ft. tape measures; (5) clip boards; (6) 1/2 dz. blue pencils; (7) footage cards and stakes

Instructions to Tester

This is basically a test for coordination. Subjects will get two trials to throw the 8-inch softball as far as they are able. Only their better throw will be recorded. The field is measured at 10-foot intervals beginning 30 feet from the restraining line and ending at 200 feet. Hashmarks will be placed at 5-foot intervals. Lines will be marked so they are parallel to the restraining line.

As each ball is thrown a recorder will place a bean bag at the stop where the ball first lands. The recorder will follow the same procedure unless subsequent throws fall short of the preceding throw. The instructor will remain at the restraining line and will mark the score on the subject's card. The ball will be thrown overhand from behind the restraining line and from between the restraining line and from between the two lines drawn 6 feet apart marking the throwing area.

Read the instructions to the group as they assemble at the test area. Allow the group to warm-up by tossing a minimum of five bean bags from behind the restraining line out into the test area.

Read the following instructions once then ask for any questions. Allow several minutes for practice or warm-up throws. Do not give any other words of instruction or words of encouragement.

Test Instructions

This is an overhand throw for distance with a softball. You will have two tires to throw this ball overhand as far as you are able. Your better score will be counted.

You must make your throws from between these two lines (COUNT OUT 6-FOOT PARALLEL LINES). You may take one or more steps before you throw, but you must not go over this line. Do not throw a ball unitl I tell you. Remember, it must be an overhand throw. READY, THROW!

Scoring

Measurements shall be taken from the point where the ball lands to the restraining line. Measurement is taken at a right angle to the restraining line. The score shall be recorded in feet and nearest 1/2 foot. Both throws shall be recorded. Use blue pencil to record pre-test results in October 1963 and red pencil to record post-test results in the spring of 1964.

VI. SITTING REACH

Sit - Reach (Pink) - (Multipurpose Room Next to Stage)

Maximum Number of Participants - 20

Anticipated Time per Person - 3 minutes

Equipment

(1) 4 benches with 20 rulers; (2) clip boards;
(3) 1-1/2 dz. blue pencils.

Instructions to Tester

This is a test for flexibility. The subjects will sit on the floor facing the board and place their feet flat against the board with their legs and heels flat on the floor. The ruler nearest the subject measures (-) while the ruler away from the subject measures (+). The subject sits in the correct position on the floor with the plane of the ruler bisecting the body.

The subject bends forward at the waist, places his outstretched arms and fingers together in front. The subject's fingers must be placed on top of the ruler to measure the degree of flexibility.

The subject will bounce forward twice and then hold for the measurement on the third bounce. The count will be a fairly rapid "BOUNCE! BOUNCE! HOLD!" Two trials will be allowed with both scores recorded. You should demonstrate the correct position and go through the actual test once.

Read the following instructions through once then ask for any questions. Do not give any other words of instruction or words of encouragement.

Test Instruction

This is a test to see how far you can reach. Sit on the floor with your legs and heels flat on the floor. (PAUSE WHILE THEY ARE SITTING) The bottom of your feet should be flat against the board with the ruler between your feet. Stretch your arms and fingers forward with your hands touching. On the signal, "READY, GO!" and the count of "BOUNCE! BOUNCE! HOLD!" you bend forward as far as you can three times holding the position forward on the third count so your score can be measured. You may now practice. Listen to the signal and count. "READY, GO!" "BOUNCE! BOUNCE! HOLD!" (Have recorders correct positions.) Please stand up now and I will demonstrate the correct position and go through the test. (DEMONSTRATE) You will get two trials with the better recorded. Please sit on the floor in the correct position and listen for the signal to begin. READY GO! BOUNCE! BOUNCE! HOLD! Second Trial . . . READY, GO! BOUNCE! BOUNCE! BOUNCE! HOLD!

Scoring

Record both trials in terms of either (-) or (+) inches and eighths of inches. Record the pre-test results in blue pencil in October 1963 and the post-test results in red pencil in the Spring of 1964.

VIII. ANTHROPOMETRIC MEASUREMENTS - (Orange) - (Stage)

Personnel - Nurse, 4 tester-recorders

Maximum Number of Participants - 4

Anticipated Time per Person - 4 minutes

Equipment

(1) 4 chairs; (2) 4 calipers; (3) 7 curtains;

(4) 8 8-foot high jump standards; (5) wire;

(6) 4 clip boards; (7) 6 blue pencils.

IX. MEASUREMENTS

Height - Weight and Sitting Height (Black) - (Classroom)

Personnel - Classroom teacher, recorder

Maximum Number of Participants - 2

Anticipated Time per Person - 1 minute

Equipment

(1) 1 set scales with height measurement;

(2) 10 chairs (1 with measurement for height);

(3) clip board; (4) 2 blue pencils.

X. GENERAL INFORMATION - Individual Classroom

Personnel - Classroom teacher

Equipment

(1) 2 blue pencils; (2) CA's; (3) test scores.

OTHER FACILITIES, PERSONNEL AND EQUIPMENT:

1. 1 table and chair between outside exit and cafeteria alcove

   1 adult

   1 dozen extra blue pencils; 3 extra stop watches; extra tape; 2 extra magic markers

2. 1 table and chair between cafeteria alcove and stage (near alcove)

   1 adult

3. 1 table and 2 chairs in hall near multipurpose room doors

   1 adult, 1 student runner

4. 1 table and 2 chairs between stage and storage room (near stage)

    1 adult, 1 student runner

    Note paper and pencils

    1 dozen extra blue pencils

5. 1 table and 2 chairs outside storage room near outside exit

    1 adult, 1 student runner

ESTIMATED TIME SCHEDULE

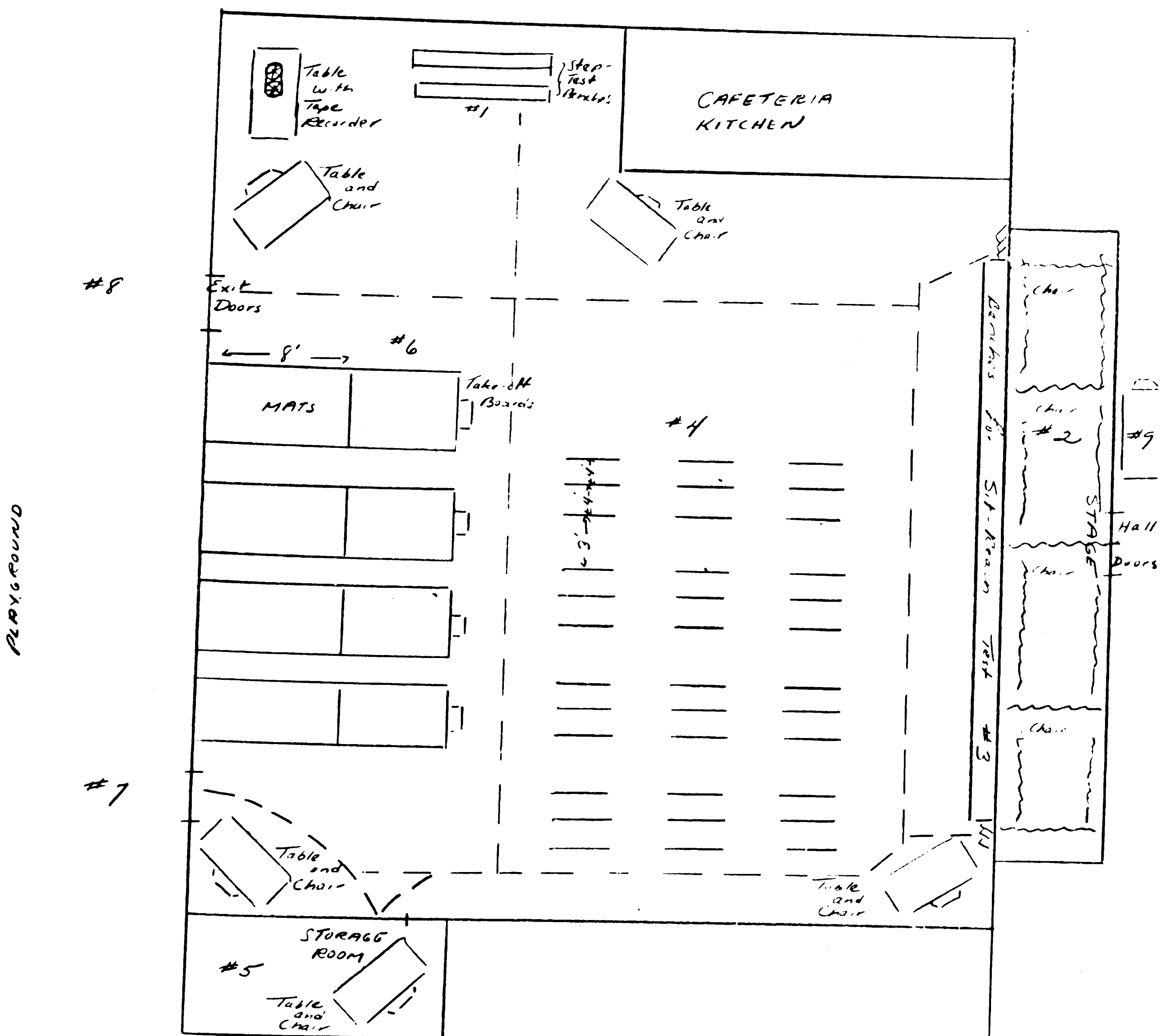
45 minutes per grade level

Grades 1 - 3 A.M.

Grades 4 - 6 P.M.

PROJECT 'E'

Direction Sheet for Teachers, Recorders, Testers and Other Adult Personnel



KEY

Traffic Flow Lanes - - -

#1 Step Test	#4 Side Step	#7 Softball Throw
#2 Anthropometric	#5 Strength Test	#8 40-Yard Dash
#3 Sit Reach	#6 Broad Jump	#9 Height-Weight

ITEM 5

HAND DYNAMOMETER CONVERSION TABLE

Item 5

TABLE 6.3.--Hand Dynamometer Conversion Table--
Pounds to Kilograms

12 - 5.4	35 - 15.9	58 - 26.3
13 - 5.9	36 - 16.4	59 - 26.8
14 - 6.3	37 - 16.8	60 - 27.3
15 - 6.8	38 - 17.3	61 - 27.7
16 - 7.3	39 - 17.7	62 - 28.2
17 - 7.7	40 - 18.2	63 - 28.6
18 - 8.2	41 - 18.6	64 - 29.1
19 - 8.6	42 - 19.0	65 - 29.5
20 - 9.1	43 - 19.5	66 - 30.0
21 - 9.5	44 - 20.0	67 - 30.4
22 - 10.0	45 - 20.4	68 - 30.9
23 - 10.4	46 - 20.9	69 - 31.3
24 - 10.9	47 - 21.3	70 - 31.8
25 - 11.3	48 - 21.7	71 - 32.3
26 - 11.8	49 - 22.3	72 - 32.7
27 - 12.2	50 - 22.7	73 - 33.2
28 - 12.7	51 - 23.2	74 - 33.6
29 - 13.1	52 - 23.6	75 - 34.1
30 - 13.6	53 - 24.1	76 - 34.5
31 - 14.1	54 - 24.5	77 - 35.0
32 - 14.5	55 - 25.0	78 - 35.4
33 - 15.0	56 - 25.4	79 - 35.9
34 - 15.4	57 - 25.9	80 - 36.4

ITEM 6

SOCIO-ECONOMIC DIRECTIONS

OCCUP TION [illegible]

Level	A. Professionals	B. Proprietors	C. Business Men	D. White Collar Workers	E. Manual Workers	F. Service & Miscellaneous	G. Landowners & Farmers
1	**Lawyer, doctor, dentist judge, minister, professor, engineer, ind'l. Chemist, school sup'td, coun. vet'n.**	**Value $75,000 plus, depending upon nature of the community.**	**Top executives: president, mgr, etc. of corporations, public utilities, banks, et.al**	Executive secretary of status or organizations; C.P.A.; editor of reputed newspaper or magazine.			Gentlemen farmers; large landowners and operators who patronize the local activities.
2	**High school teacher; trained nurse (RN) Chirop'st, chiropractor, architect, undertaker, minister (no college).**	**Value $20,000 to $75,000.**	**Assistant, office and dept. managers or supervisors; mgrs. of medium sized branches; mfrs. agents.**	Accountant; insurance, stock and bond, real estate salesmen in reputed firms; columnist or editorial writers, etc.			Managers and land operators with active urban life. (2CM).
3	**Grade school teacher, optometrist, undertaker asst., pharmicist (employee); city vet.**	**Value $5,000 to $20,000 or similar equity.**	**Mgrs. of small branch stores and similar businesses; sales-men (better mdse. and known customers); buyers.**	Bank and broker's clerks; secty., sr. postal clerk, R.R. agent, spvsy, staff of telegraph, R.R. pub. utilities, elected civic and country officials, news paper reporter, etc.	Small contractor who works at or superintends his jobs.	Commercial pilot.	Owners and operators of good mechanized farms (1CM).
4		Value or equity $2,000 to $5,000.	**Stenographer, book-keeper, rural mail clerk; ticket agent auto salesman; auto, clothing, book, dry-goods salesman.**		Construction, factory, or mine foreman; carpenter, electr'n, plumber, welder, master mech; R.R. engineer & train-men; linotype operator, printer.	Police captain et.al.; butcher, tailor, dry cleaner (small town); Pullman conductor.	Small landowners and the "forgotten farmer" who own a "decent" place.
5		**Value or equity $500 to $2,000 (small proprietors).**	**Drug store, hardware, grocery, dime store clerks, telephone and beauty operators, dressmaker, practical nurse.**		Apprentice to skilled trades; Time-keeper; R.R. firemen & brakemen; tel. tel. linemen: Medium-skilled factory workers; lead hands, section chiefs.	Policeman; barber, gas station op'rs; butcher apprentice; bar tender, liquor salesman; head waiter.	Tenants on good farms; owners of farms who just manage to make a living.
6		**Value or equity less than $500.**			**Semi-skilled factory and production workers; warehouse men; janitor; watchman; cook.**	**Taxi and truck drivers; baggagement; delivery man; gas-station attendent; waiter or waltress.**	**Sharecroppers; established farm laborers; subsistence farmers who "work out".**
7					Laborer, miner, millhand migrant worker, sec. hand; scrub woman, laun's.	Domestic servant; bus boy, etc. Reputed lawbreakers.	Migrant workers, unestablished and does not want to be.

Item 6b

Table 6.4.--Conversion of Occupational Ratings to [illegible] Scale

Column 19, 20	Column 21
0	0
1 A	1
2 D	3
3 B, C	3
4 F	2
5 G	[illegible]
6 E	4
7	[illegible]

Item 6c

School District of the City of Pontiac

DEPARTMENT OF PHYSICAL EDUCATION,

ATHLETICS AND RECREATION

October 18, 1963

Code no. of child______

Parent-Teacher Conference
(Data for Project "E")

Instructions: You have a copy of the occupational classifications and the sub-classifications under each. Determine under which main heading the father's occupation (or chief wage earner, or both parents if each are working) should be placed. Place the letter of this occupation in the space provided below. Under each main heading, find the number of the sub-classification under which the specific occupation falls. Write this number in the space provided. For example, if the father is a high school teacher his main classification would be "A" (Professional), and his sub classification would be "2" (high school teacher). Only the letter and the number need be recorded.

Child's Name____________________ Teacher's Name________________

Grade_______ Father's Name______________ Address________________

Main Occupational Classification______________________________

Sub-Classification________________________

Mother's Name_______________________ Address__________________
(if different from father's)

Main Occupational Classification______________________________

Sub-Classification_______________________

ITEM 7

PROJECT "E" TEST DATA SHEET

PROJECT "E"
PONTIAC PUBLIC SCHOOLS

Code ______________________
Pre Test: October 1963
Post Test: ______________ 1964

1. GENERAL INFORMATION

Name____ Height______ Age______________
last first initial inches month day year

Race: W N Sex: M F Grade:______________ Socio-Economic Status______________________

	Pre-Test Raw Score	Pre-Test Standard Score	Post Test Raw Score	Post Test Standard Score
I. Q.				
Academic Achievement Level				
Motor Performance				
Social Rating				
Emotional Scale				

2. ANTHROPOMETRIC MEASUREMENTS

Variable	Measurements									
Age (chronological)	Month______			Day______				Year______		
			SS			SS				
Height (in.)	______inches		______	______inches		______				
Weight (lbs.)	______inches		______	______inches		______				
Sitting Height	______pounds		______	______pounds		______				
Skinfold Sites	______inches		______	______inches		______				
				SS					SS	
Subscapular	______	______	______mm	______	______	______	______mm	______		
Triceps	______	______	______mm	______	______	______	______mm	______		
Biceps	______	______	______mm	______	______	______	______mm	______		
Suprailiac	______	______	______mm	______	______	______	______mm	______		
Waist	______	______	______mm	______	______	______	______mm	______		
Umbilicus	______	______	______mm	______	______	______	______mm	______		
Relative Body Weight	______%			______	______%			______		
Ponderal Index (ht. / (weight.										

3. MOTOR PERFORMANCE SCORES

TRIALS

BATTERY	Pre-Test 1st	Pre-Test 2nd	Pre-Test T Score	Post-Test 1st	Post-Test 2nd	Post-Test T Score
40-Yard Dash (sec. - 10th sec.)						
Standing Broad Jump (inches)						
Softball Throw (distance — ft. - ½ ft.)						
Side Stepping (No. times in 10")						
Strength (R-L)	R L	R L	R L	R L	R L	R L
Sit-Reach (inches - 10th inch)						
8" Step Test (30 step count — 30" Pulse Count 1' after exercise)						

ITEM 8

PERSONNEL TRAINING AND TESTING

Item 8a.

School District of the City of Pontiac

DEPARTMENT OF PHYSICAL EDUCATION,

ATHLETICS AND RECREATION

October 15, 1963

TO: Principals Involved in Project "E"

FROM: Lee W. Haslinger

RE: Testing Arrangements

Organizational Arrangements

Monday 21
On Tuesday, October 22, the team of testers from Michigan
Thursday 24
State University and from Pontiac will be in your building. Hopefully, the primary grades will be tested in the morning and the upper grades will be tested in the afternoon.

As per discussion, the classroom teachers will be expected to accompany their classes thru the battery of physical performance and anthropometric tests on this day for the purpose of facilitating the time schedule. (Obviously the regular physical education programs will be cnacelled on this day). It is also expected that the teachers will procure, at another time, the socio-economic status (as per enclosed form), the birthdate of each child, and will administer the academic achievement tests (and score them in grades one and two).

Facilities and Equipment from the School

10 chairs and 7 tables are needed in the gymnasium for the performance tests.

Scales and yardstikcs will be set up in a room designated by the principal.

A tape recorded in the gymnasium.

(For arrangement of these items see accompanying sheet).

We appreciate your extending and confirming these arrangements with your teachers and enginneers. We are appreciative of your cooperation and trust that the results of this effort will be beneficial to your teachers.

Thank you,

LWH:hw

Item 8a.

School District of the City of Pontiac

DEPARTMENT OF PHYSICAL EDUCATION,

ATHLETICS AND RECREATION

February 5, 1964

TO: Elementary School Principals, Classroom Teachers and Physical Education Teachers Selected for Project "E"

FROM: Lee W. Haslinger and Jean M. Young

SUBJECT: PROJECT "E"

Please refer to a Project "E" score sheet for recording. Items checked below should be recorded by the teachers.

1. General Information
    - Code X
    - X Pre-test: October 1963 (circled)
    - Name X
    - Height X
    - Age X (month and year)
    - X Race (circled
    - X Sex
    - Grade X
    - Socio-economic Status X (according to chart)

    The next items should be recorded under "Raw Score" (Pre-test): I.Q. X (Grade 1--Pintner-Cunningham this year; Grade 2--no record; Grades 3 & 5--California Mental Maturity this year; Grade 4--Californai Mental Maturity given last year; Grade 6--California Mental Maturity given two years ago)

    Academic Achievement Level--Do not record--will be taken from County Records.
    Motor Performance (leave blank--these will be computed at the County Office.)
    Social Rating X (SA score--total items 1-46)
    Emotional Scale X (S Score--total items 48-84)

2. Anthropometric Measurements
   Height __X____ inches
   Weight __X____ pounds ("inches is a misprint)
   Sitting Height __X___ inches ("pounds" is a misprint)

As soon as these items have been recorded, will you please give us a call so we can collect the Project "E" records for tabulation.

Thank you.

Encl: 1-Project "E" (one per principal)
2-SA-S Tests (one per student)
3-SA-S Test Scoring Sheets (one per teacher)
4-SA-S Explanation Sheet

Item 8a

PROJECT "E"

Report to date: January 1963

Data collected and completed

Anthropometric Measurements
Thank-you's to appropriate sources

Data needed

Socio-economic Status (completed?)
Academic Achievement (completed?)
Motor Performance (completed)

Directives

1. Gales, Janic, Tom and Jim--check forms with teachers on data needed and hand into physical education office by January 31.

2. Lee and Jean take completed forms to resource persons (locally and MSU) for setting up IBM processing.

3. Processing of cards (either at county or MSU as predetermined).

4. From processing, determine sampling to be used--determined with MSU staff.

5. Prepare for spring re-test
   a. Forms distributed from physical education office
   b. Contacts made by Lee and Jean with MSU
   c. Contacts made by physical education staff to principals and teachers
   d. Inventory of equipment by physical education staff
   e. W.O.--distribution of equipment by Jean after school dates are determined
   f. Contacts for local help made by physical education staff, Lee and principals

6. Checking of forms by physical education teachers and handed into physical education office.

7. Processing of cards

8. W.O. on equipment return

9. Thank you's to appropriate sources

10. Compiled report--Lee and Jean

Item 8b

BODY MEASUREMENTS OF CHILDREN K-6TH GRADE

Informative Value of Measurements

Length measurements are concerned with: (1) total body length and (2), when crownrump or sitting height are included, the relative contribution of trunk and legs.

Weight indicates gross body size (bulk) and gives a rough approximation of body volume.

Body circumferences and diameters indicate laterality of build, and (in early infancy) developmental status.

Leg and arm circumferences, as well as the body circumferences, indicate extent of development of the soft tissues, fat and muscle.

"Skin-folds" (i.e. folds of skin plus subcutaneous tissue) indicate the thickness of the subcutaneous fat, and help to differentiate fat from muscle.

A. Length and Weight (Minimum measures)

1. Age: record day, month, year.

2. Height (stature): Subject removes shoes; stands with back against the calibration on the stadiometer; heels, hips, shoulders and head touching the backboard. The head should be erect with the chin tucked in slightly. The Frankfort plane (line from the outer, lower corner of the eye socket to the little prominence at the front of the lower ear lobe) should be horizontal. Subject should stand as tall as possible.

   The square is placed against the calibration on the backboard above the head of the subject. It is brought down until it fits firmly against the top of the subject's head. The square must fit both the backboard and the head must be horizontal, not tilted. The reading is taken at the lower edge of the square. It may be helpful to ask the subject to bend knees and step away. Record to nearest 1/4 inch or centimeter. Metric system preferred.

3. Weight: Subjects should always be weighed without shoes, coats, sweaters, or other heavy garments. It is preferable to weigh in the nude or only with minimum underclothing, but children in school usually cannot be weighed in that fashion. Uniformity in amount of clothing from time to time for each person is the next best goal.

Estimate the weight of the subject and place the heavy weight on the balance arm of the scale in the groove for the first unit below the estimated weight. The subject stands in a steady position on the center of the platform and the small weight is moved until the balance arm is in a steady position. Be careful to read the weight at the proper edge of the weight or hairline designated for the reading. Record to nearest half pound or half kilogram. Kilograms preferred.

4. Sitting Height: A bench or box high enough to keep feet resting levelly on floor and kness bent to right angle. Subject is instructed to sit with his scapular and sacral regions resting vertically against the surface of the wall. From the highest point in the sagittal plane of the head to the surface upon which the subject is sitting. Head in plane of the visual axis. Record to nearest 1/4 inch or centimeter. Metric system preferred.

B. Circumferences (<u>should be added for survey work</u>)

The tape is used for all measures of circumference or girth. It may be obtained in either linen or steel. The linen is subject to shrinkage from perspiration picked up during measurement, and if used over long periods of time may eventually become worn and stretched. Either type of change would destroy the accuracy of the measurement. The steel tape avoids the problem of changing units but has the disadvantage of feeling cold to the subject. This reaction to the cold could easily affect chest measurement and might even affect muscle girths. Care can be taken to see that the tape is reasonably warm to touch and therefore the steel tape would seem to be the better choice. <u>Take three independent readings. Record each to nearest centimeters.</u>

<u>Circumference Sites</u> (cm):

1. Upper arm: Should be taken with the arm hanging freely, at a right angle to the long axis of arm and at the same level as the arm skinfold measurement. The tape should be applied lightly to the skin, without deforming its contour. Where direct anthropometric measurements must be used, the muscular development can be estimated from the limb circumferences, provided that the thickness of the subcutanious layer is determined at the same time and preferably, at the same level. Record to nearest centimeter.

2. Calf girth (lower leg): Have the subject stand with feet slightly apart and weight equally distributed between the two feet. Place the tape around the lower leg at its largest circumference (over the bulge of the gastrocnemius) in a horizontal position. Cross the tape to get the point for the reading. The tape should be pulled just tight enough to keep it from slipping, but not tight enough that it makes an indentation in the contour of the leg. Record to nearest centimeter.

3. Axillary chest girth: The tape applied well up in the axillary fossae. Mean reading of measurements during noraml inspiration and expiration. Record to nearest centimeter.

C. Diameters (Desirable for survey work, requires little equipment)
Sliding Caliper Techniques (subject standing):

The following measures are taken with the sliding caliper. In order to avoid fatigue if doing measures on a number of subjects and to facilitate measurement it is essential that the caliper be balanced on the hands. The fixed arm of the caliper should be taken in the nondominant hand. The hand is underneath and the caliper arm rests between the thumb and index finger as one would hold a pencil. The movable arm is taken in the dominant hand in the same fashion, like a pencil projecting between thumb and index finger for writing. The grip is far enough back on the arms so that the caliper balances on the hands without being grasped.

The movable arm is carried back and forth by its position in the V of the hand. The middle finger is immediately below the caliper arm and is used to locate the landmarks and then the caliper is slipped down to fit onto the landmark. This also avoids using the ends of the caliper arms for the contact and permits a very relaxed use of the hands during the measurement. Take three independent readings. Record to nearest centimeter.

Diameter Sites (cm):

1. Bi-acromial: The measurement is taken behind the subject; the scapulae should be flat and mildly adducted so that the arms hang easily at the sides. The fixed arm of the caliper is placed against the end of the acromion process of the left shoulder, and the movable arm is brought in a corresponding position firmly against the right acromion. The end of the middle finger should be used to locate

the landmark and then the arm of the caliper is moved down into position. (Placing the caliper too high permits it to slip when pressure is applied. Placing it too low increases the reading by getting it over the tuberosity of the humerus and the bulk of the deltoid muscle).

2. Bi-cristal: The measurement is taken facing the subject. The fixed arm of the caliper is placed against the crest of the ilium, with about a quarter inch of the caliper extending down the side of the ilium. The end of the caliper arm should project backward beyond the area of contact. The movable arm is brought in a similar position against the left ilium. Pressure is applied. (Placing the caliper too high permits it to slip when pressure is applied. Placing it too low increases the reading by getting it over the lateral gluteals and the fat pad which frequently covers these muscles).

D. Skinfold (Desirable, but requires equipment less readily available)

Skinfold Techniques[1] (Lange Skinfold Calipers - 10 gm/mm pressure)[2]

The skinfolds are grasped between the thumb and index finger of left hand. The span of the grasp is dependent on the thickness of the skinfold. The size of the fold should be enough to include two thicknesses of skin and subcutaneous fat but no muscle or fasica.

The application of the calipers is about 1 cm from the fingers and at a depth approximately equal to the thickness of the fold. Three successive measurements are taken at each site. The right side of the body is preferred.

All folds are taken in the vertical plane except where the lines of Linn result in torsion of the skinfold then the skinfold is taken along these lines (diagonally). Take three independent reading in first 3-5 seconds after applying the instrument.

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[1]Committee on Nutritional Anthropometry of the Food and Nutrition Board, National Research Council. In Body Measurements and Human Nutrition. J. Brozek, ed. Detroit: Wayne University Press, 1956.

[2]Montaqu, M. F. Ashley, 1960. A Handbook of Anthropometry, Charles C. Thomas.

Skinfold Sites (mm)

1. Upper arm skinfold (triceps): This site is readily accessible in individuals of both sexes and should be measured in all studies of leanness-fatness. The skinfold is located at the back of the right upper arm (over the triceps), at the level midway between the tip of the acromial process of the scapula and the tip of the elbow. The level is located with the forearm flexed at 90°. In making the skinfold measurement, the arm should hang down freely. The skinfold is lifted parallel to the long axis of the arm. Subject standing.

2. Scapular skinfold: The skinfold measured below the tip of the right scapula provides a good characterization of the individual's overall fitness. The thickness of the subcutaneous adipose tissue is fairly homogenous in this area and small differences in locating the site are less important than in the arm or abdominal region or chest. The skinfold running downwards and outwards in the direction of the ribs. Subject standing.

3. Lower ribs (chest): Taken on the lateral aspect of thorax over the lower rib midway between the axilla and iliac crest.

4. Waist: Waist on mid-axillary line, half-way between the lower rib and the iliac crest. May have to lift diagonally. Subject standing.

5. Supra-iliac: Taken on the mid-axillary line. The folds run forward and slightly downward. Subject standing.

6. Umbilicus abdomen: Just to the right of the umbilicus (one third the distance from the umbilicus to the iliac crest). The subject is preferably in the relaxed supine position. Take this standing.

7. Chin: Under the mandible.

ITEM 9

PROGRESS REPORTS

Item 9

School District of the City of Pontiac

DEPARTMENT OF PHYSICAL EDUCATION,

ATHLETICS AND RECREATION

October 28, 1963

TO: All Persons Involved in Project "E"

FROM: Lee W. Haslinger and Jean Young

SUBJECT: PROGRESS REPORT

The initial testing at the control and experimental schools is now completed. We did not get finished, so return trips to each school will be necessary. The return trip will not be so disruptive to the school schedule.

The testing began at Owen School on Monday, October 21. We started 492 children through the nine tests at Owen; 463 children on Tuesday at Mark Twain, and 535 children on Thursday at LeBaron. A majority of these children completed the battery of eight motor performance tests. The anthropometric measurements take more time and here we have much work to do.

At Owen, 247 children, or 50%, completed their anthropometric measurements; 301, or 65%, at Mark Twain; and 297, or 55%, at LeBaron. We have trained two members of our elementary physical education staff to take these measurements so we will make some arrangements to return to the schools.

For the most part, the academic achievement test batteries are at the schools and should be completely administered in the very near future. Mark Twain has already completed their testing and LeBaron has a good start.

Material is in the hands of all teachers at the three schools so they may obtain the socio-economic status of the youngsters. There is no urgency in obtaining this information.

The test forms are in the hands of the teachers and they should record the age, I.Q., achievement test score, sex, race, and grade. It may be necessary for teachers to get height, weight, and sitting height measurements in stocking feet, since some schools had youngsters measured with their shoes on. Also, we may ask teachers to record the results of each achievement test battery on a special form but more information will be given on this in the near future.

The initial testing phase of Project "E" has involved the cooperation and assistance of many people including: Mr. Abbott, Mr. VanKoughnett, and Mr. Stanley and their teachers; engineers and custodians and cafeteria personnel; Mr. Lacy, Mr. Fell, Mr. Embree, Mr. White, Mr. Wilbur Johnson, Mr. Houts, Mr. Carr, Mr. Wright, Mr. Neff; carpenters; bus and truck drivers; Jo Seeley and her staff of nurses; elementary principals for releasing our staff on Tuesday; Mr. Ted Carlson and his printing classes at Central High School; our secretaries and those at the schools; interested partent; P.T.A. Health Charimen at Owen, Twain and LeBaron Schools; the elementary physical education staff; other community helpers, Dr. Wessel, Dr. VanHuss, Dr. Huesner, Dr. Michaels, MSU students from the tests and measurements class; Dr. Whitmer and the Pontiac elementary school youngsters.

To all of these people we give our warmest thanks.

PROJECT "E"

Report to date: January 1964

Data collected and completed
- Anthropometric Measurements
- Thank-you's to appropriate sources

Data needed
- Socio-economic Status (completed?)
- Academic Achievement (completed?)
- Motor Performance (completed)

Directives

1. Gale, Janic, Tom and Jim-check forms with teachers on data needed and hand into physical education office by January 31.

2. Lee and Jean take completed forms to resource persons (locally and MSU) for setting up IBM processing.

3. Processing of cards (either at county or MSU as predetermined).

4. From processing, determine sampling to be used--determined with MSU staff.

5. Prepare for spring re-test
   a. Forms distributed from physical education office
   b. Contacts made by Lee and Jean with MSU
   c. Contacts made by physical education staff to principals and teachers
   d. Inventory of equipment by physical education staff
   e. W. O.--distribution of equipment by Jean after school dates are determined
   f. Contacts for local help made by physical education staff, Lee and principals

6. Checking of forms by physical education teachers and handed into physical education office.

7. Processing of cards

8. W. O. on equipment return

9. Thank you's to appropriate sources

10. Compiled report--Lee and Jean

ITEM 10

NUMBER, MEANS AND STANDARD DEVIATIONS

Item 10a

TABLE 6.5.--Number, Means and Standard Deviations for Academic Achievement Variables.

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Academic Vocabulary	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	2.0	2.9	4.0	5.0	5.6	5.7	5.1	2.0	3.2	3.9	5.3	5.8	6.8
	SD	.8	1.1	1.5	1.6	1.6	1.4	1.0	.3	.9	1.1	1.3	1.5	1.8
Reading Compre-hension	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	2.3	3.0	4.2	4.9	5.6	5.5	5.5	2.3	3.5	4.1	5.5	5.9	6.8
	SD	1.0	1.4	1.6	1.5	1.6	1.6	1.1	.5	1.0	1.0	1.2	1.2	1.6
Total Language	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	1.9	2.7	4.0	5.1	5.5	5.6	5.5	2.0	3.3	4.2	5.7	6.3	7.4
	SD	.6	1.0	1.3	1.4	1.5	1.7	1.3	.4	.9	1.1	1.4	1.3	1.7
Total Work Study	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	1.9	2.6	4.0	4.8	5.6	5.4	5.6	1.7	3.1	3.9	5.4	5.8	6.8
	SD	.8	.8	1.4	1.2	1.5	1.5	1.1	.4	1.0	1.0	1.1	1.2	1.4

TABLE 6.5.--Continued

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Total	N	10	12	26	58	53	24	11	11	18	17	32	25	16
Arithmetic	M	2.4	3.3	3.9	4.9	5.6	5.4	6.1	2.3	3.4	4.0	5.2	5.6	6.2
	SD	.5	1.1	1.2	1.0	1.3	1.3	1.0	.3	.8	.9	.9	1.0	1.1
	N	10	12	26	58	53	24	11	11	18	17	32	25	16
Composite	M	2.1	2.9	4.0	4.9	5.6	5.5	5.6	2.1	3.3	4.0	5.4	5.9	6.8
	SD	.7	1.0	1.3	1.2	1.4	1.4	1.0	.3	.9	1.0	1.1	1.1	1.5

Item 10b

TABLE 6.6.--Number, Means and Standard Deviations for Social Approachability and Emotional Stability.

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Social Approach-ability (SA)	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	18.8	22.5	23.6	23.7	23.5	23.1	24.2	25.5	26.4	25.1	27.3	26.5	26.0
	SD	.4	.6	.4	.4	.5	.5	.5	.5	.4	.5	.4	.6	.4
Emotional Stability (S)	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	12.5	13.1	13.9	14.2	14.3	15.2	14.4	12.7	11.0	9.1	14.7	12.2	13.4
	SD	.6	.4	.7	.6	.5	.5	.4	.4	.6	.5	.7	.6	.6

TABLE 6.7 .--Number, Means and Standard Deviations for Anthropometric Variables.

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Actual Height	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	48.4	51.0	53.2	54.6	56.8	57.1	58.4	48.8	50.5	52.4	55.2	55.8	56.8
	SD	1.7	3.1	2.3	2.6	3.1	3.7	3.7	2.2	2.9	2.1	2.8	2.9	3.0
Sitting Height	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	26.6	27.3	28.0	28.4	29.3	29.1	30.7	26.5	26.7	27.4	29.4	28.9	31.3
	SD	1.1	1.4	1.3	1.2	1.6	1.5	2.0	1.3	1.7	1.2	3.6	1.7	7.9
Leg Length	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	21.8	23.7	25.2	26.2	27.5	28.0	27.7	22.3	23.8	25.1	25.8	26.9	25.6
	SD	.9	1.9	1.5	1.9	2.1	2.6	3.0	1.0	1.8	1.7	4.3	1.8	7.7
Standard Height	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	48.6	51.0	52.3	54.6	55.8	56.8	58.3	48.3	50.1	52.4	54.7	55.7	56.7
	SD	.3	1.0	1.6	1.2	1.2	1.3	1.0	.3	1.5	1.2	1.1	2.9	1.3
Relative Weight	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	99.6	100.0	101.6	100.0	101.8	100.7	100.3	100.9	100.8	100.1	100.9	100.2	100.2
	SD	3.3	5.7	3.3	4.5	5.2	6.7	7.1,	4.3	4.6	3.8	5.1	5.6	5.4
Actual Weight	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	52.1	61.5	73.0	76.0	86.0	83.5	98.3	58.2	58.1	64.0	80.3	77.2	90.1
	SD	6.3	12.4	15.5	16.1	19.8	15.3	29.4	8.9	11.9	9.4	21.0	17.4	27.6
Standard Weight	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	53.2	59.4	63.7	70.7	75.5	78.8	84.6	52.5	56.6	62.8	70.2	75.3	77.5
	SD	1.1	2.6	4.3	4.3	4.7	4.8	4.0	.9	3.7	3.5	3.7	2.4	6.1

TABLE 6.7.--Continued

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Relative Weight	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	98.1	103.3	114.3	107.6	113.8	106.3	117.0	110.7	102.3	102.1	114.5	103.2	116.9
	SD	1.2	1.9	.2	2.2	2.4	2.0	3.7	1.7	1.8	1.5	2.9	5.9	3.7
Ponderal Index	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	13.0	13.0	12.8	13.0	12.9	13.1	12.8	12.6	13.1	13.1	12.9	13.2	12.8
	SD	.4	.3	.5	.6	.6	.6	.7	.5	.5	.4	.7	.6	.6
Triceps Skinfold	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	8.5	13.6	13.8	12.8	12.9	11.5	12.9	13.5	10.2	12.7	16.5	14.8	16.8
	SD	2.3	1.4	5.3	5.6	5.2	5.0	4.8	4.8	3.0	6.1	7.2	7.4	5.9
Subscapular Skinfold	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	4.9	9.4	9.4	8.4	9.1	8.5	10.6	8.7	7.6	7.8	12.8	9.4	12.3
	SD	.8	1.2	6.6	4.9	4.8	4.8	5.4	2.6	3.1	3.2	8.1	6.5	6.5
Abdominal Skinfold	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	5.5	10.1	12.9	10.8	13.0	11.9	15.6	12.5	6.9	9.1	18.8	12.5	17.4
	SD	1.5	1.1	9.0	7.8	10.0	7.8	8.7	5.9	3.5	5.2	14.6	9.9	9.1
Sum-Fat Measurements	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	18.9	33.0	36.0	31.9	35.0	31.9	39.1	34.7	24.7	29.6	48.1	36.7	46.6
	SD	4.6	3.7	2.0	1.7	1.8	1.7	1.7	1.2	9.3	1.3	2.8	2.1	2.0
Upper Arm Circumference	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	17.5	18.8	20.6	20.6	21.6	21.6	23.0	19.8	18.8	19.1	21.1	20.1	21.8
	SD	1.3	2.2	2.6	2.5	2.6	2.4	3.8	1.7	1.6	1.6	3.0	2.6	2.8

TABLE C.7--Continued

		Boys							Girls					
Age Group		2	3	4	5	6	7	8	2	3	4	5	6	7
Chest Inspiration	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	62.4	65.6	69.0	70.2	71.5	72.6	76.2	61.9	63.5	64.9	68.9	66.5	69.9
	SD	2.7	3.8	6.3	5.0	10.7	5.0	9.7	3.8	5.1	3.4	7.5	6.4	7.4
Chest Expiration	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	59.2	62.4	65.1	66.0	67.4	67.6	72.7	59.2	60.2	62.3	65.9	63.1	66.8
	SD	2.9	6.1	6.4	6.0	10.4	5.1	10.2	3.7	5.2	4.0	8.0	7.1	7.6
Difference Expiration-Inspiration	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	3.2	3.2	3.9	4.3	4.1	5.0	3.5	2.7	3.2	2.6	2.9	3.3	3.1
	SD	.90	3.3	1.5	2.7	1.4	2.6	1.5	.7	1.2	2.1	1.7	1.5	1.2
Biocromial Diameter	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	26.8	28.0	29.3	29.9	30.6	31.0	32.2	27.1	27.9	28.8	30.7	29.9	31.1
	SD	8.4	2.0	1.9	1.7	2.9	2.1	2.3	1.3	2.1	1.4	1.9	2.5	1.8
Bicrestal Diameter	N	10	12	26	58	53	24	11	11	18	17	32	25	16
	M	18.7	20.4	21.0	20.9	21.9	21.9	23.2	19.6	20.8	21.3	23.3	22.3	23.4
	SD	8.9	1.9	1.6	1.7	1.4	1.4	2.7	2.8	1.9	1.3	2.6	2.2	2.1

TABLE 6.8.--Number, Means and Standard Deviations for Performance Variables.

Age Grouping	40 Yard Dash		Standing Broad Jump		Softball Throw (yards)		Right Grip		Left Grip		Sum Left-Right Grip		Cardio Vascular Pulse Count	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
BOYS														
2	8.4	.5	4'3"	1.0	49	.7	18.9	.8	20.0	1.0	38.9	1.8	39	.8
3	7.9	1.1	4'9"	.7	63	2.0	34.5	2.2	28.4	1.4	63.0	3.6	42	.9
4	7.4	.8	4'6"	.6	63	1.8	36.2	1.1	34.6	1.1	70.8	2.1	45.8	.8
5	7.1	.6	5'2"	.7	80	2.0	40.9	1.1	36.2	1.0	77.1	2.0	43.1	1.0
6	7.0	.5	5'4"	.8	90	2.1	45.7	1.3	41.8	1.2	87.5	2.4	44.3	1.1
7	7.1	.5	5'7"	.7	88	1.9	46.8	1.2	44.0	1.2	90.7	2.2	39.6	.7
8	7.0	.5	5'3"	1.0	97	3.3	40.8	2.3	37.5	2.2	78.3	4.5	41.0	1.1
GIRLS														
2	8.7	.8	4'0"	.7	24	.6	21.3	.8	19.0	.6	40.3	1.3	46.8	1.1
3	8.2	.7	4'1"	.5	27	.8	22.6	.9	22.8	.9	45.3	1.7	43.6	.7
4	7.6	.5	4'5"	.5	32	1.1	28.9	.8	29.1	.9	57.9	1.5	46.2	.9
5	7.4	.6	5'0"	.8	45	1.5	42.0	1.2	37.3	1.0	79.3	2.2	46.2	1.0
6	7.3	.6	5'3"	.9	46	1.2	39.3	.7	37.0	.8	76.3	1.4	51.1	1.1
7	7.3	.5	5'2"	.8	49	1.5	40.9	.9	37.2	.8	78.1	1.6	47.2	1.1

ITEM 11

CORRELATION COEFFICIENTS SIGNIFICANCE LEVELS

TABLE VI. *Values of the Correlation Coefficient for Different Levels of Significance**

df	P = .10	.05	.02	.01
1	.988	.997	.9995	.9999
2	.900	.950	.980	.990
3	.805	.878	.934	.959
4	.729	.811	.882	.917
5	.669	.754	.833	.874
6	.622	.707	.789	.834
7	.582	.666	.750	.798
8	.549	.632	.716	.765
9	.521	.602	.685	.735
10	.497	.576	.658	.708
11	.476	.553	.634	.684
12	.458	.532	.612	.661
13	.441	.514	.592	.641
14	.426	.497	.574	.623
15	.412	.482	.558	.606
16	.400	.468	.542	.590
17	.389	.456	.528	.575
18	.378	.444	.516	.561
19	.369	.433	.503	.549
20	.360	.423	.492	.537
21	.352	.413	.482	.526
22	.344	.404	.472	.515
23	.337	.396	.462	.505
24	.330	.388	.453	.496
25	.323	.381	.445	.487
26	.317	.374	.437	.479
27	.311	.367	.430	.471
28	.306	.361	.423	.463
29	.301	.355	.416	.456
30	.296	.349	.409	.449
35	.275	.325	.381	.418
40	.257	.304	.358	.393
45	.243	.288	.338	.372
50	.231	.273	.322	.354
60	.211	.250	.295	.325
70	.195	.232	.274	.302
80	.183	.217	.256	.283
90	.173	.205	.242	.267
100	.164	.195	.230	.254

Additional Values of r at the 5 and 1 Per Cent Levels of Significance

df	.05	.01	df	.05	.01	df	.05	.01
32	.339	.436	48	.279	.361	150	.159	[illegible]
34	.329	.424	55	.261	.338	175	.148	[illegible]
36	.320	.413	65	.244	.313	200	.138	[illegible]
38	.312	.403	75	.224	.292	300	.113	[illegible]
42	.297	.384	85	.211	.275	400	.098	[illegible]
44	.291	.376	95	.200	.260	500	.088	[illegible]
46	.284	.368	125	.174	.228	1,000	.062	[illegible]

* Table VI is reprinted from Table V.A. of R. A. Fisher, *Statistical Methods for Research W*[illegible] Oliver & Boyd Ltd., Edinburgh, by permission of the author and publishers.

Additional entries were calculated by means of formula 15.1, using the table of *t*.

The probabilities given are for a two-tailed test of significance, that is with the sign of *r* ignored. For a one-tailed test of significance, the tabled probabilities should be halved.

TABLE VII. *Table of z' Values for r**

r	z'	r	z'	r	z'	r	z'	r	z'
.000	.000	.200	.203	.400	.424	.600	.693	.800	1.099
.005	.005	.205	.208	.405	.430	.605	.701	.805	1.113
.010	.010	.210	.213	.410	.436	.610	.709	.810	1.127
.015	.015	.215	.218	.415	.442	.615	.717	.815	1.142
.020	.020	.220	.224	.420	.448	.620	.725	.820	1.157
.025	.025	.225	.229	.425	.454	.625	.733	.825	1.172
.030	.030	.230	.234	.430	.460	.630	.741	.830	1.188
.035	.035	.235	.239	.435	.466	.635	.750	.835	1.204
.040	.040	.240	.245	.440	.472	.640	.758	.840	1.221
.045	.045	.245	.250	.445	.478	.645	.767	.845	1.238
.050	.050	.250	.255	.450	.485	.650	.775	.850	1.256
.055	.055	.255	.261	.455	.491	.655	.784	.855	1.274
.060	.060	.260	.266	.460	.497	.660	.793	.860	1.293
.065	.065	.265	.271	.465	.504	.665	.802	.865	1.313
.070	.070	.270	.277	.470	.510	.670	.811	.870	1.333
.075	.075	.275	.282	.475	.517	.675	.820	.875	1.354
.080	.080	.280	.288	.480	.523	.680	.829	.880	1.376
.085	.085	.285	.293	.485	.530	.685	.838	.885	1.398
.090	.090	.290	.299	.490	.536	.690	.848	.890	1.422
.095	.095	.295	.304	.495	.543	.695	.858	.895	1.447
.100	.100	.300	.310	.500	.549	.700	.867	.900	1.472
.105	.105	.305	.315	.505	.556	.705	.877	.905	1.499
.110	.110	.310	.321	.510	.563	.710	.887	.910	1.528
.115	.116	.315	.326	.515	.570	.715	.897	.915	1.557
.120	.121	.320	.332	.520	.576	.720	.908	.920	1.589
.125	.126	.325	.337	.525	.583	.725	.918	.925	1.623
.130	.131	.330	.343	.530	.590	.730	.929	.930	1.658
.135	.136	.335	.348	.535	.597	.735	.940	.935	1.697
.140	.141	.340	.354	.540	.604	.740	.950	.940	1.738
.145	.146	.345	.360	.545	.611	.745	.962	.945	1.783
.150	.151	.350	.365	.550	.618	.750	.973	.950	1.832
.155	.156	.355	.371	.555	.626	.755	.984	.955	1.886
.160	.161	.360	.377	.560	.633	.760	.996	.960	1.946
.165	.167	.365	.383	.565	.640	.765	1.008	.965	2.014
.170	.172	.370	.388	.570	.648	.770	1.020	.970	2.092
.175	.177	.375	.394	.575	.655	.775	1.033	.975	2.185
.180	.182	.380	.400	.580	.662	.780	1.045	.980	2.298
.185	.187	.385	.406	.585	.670	.785	1.058	.985	2.443
.190	.192	.390	.412	.590	.678	.790	1.071	.990	2.647
.195	.198	.395	.418	.595	.685	.795	1.085	.995	2.994

* Table VII was constructed by F. P. Kilpatrick and D. A. Buchanan from formula 15.2.

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