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Rhythmic Methods of Teaching Motor Skills

Jeannette Pruyn Reed

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RHYTHMIC METHODS OF TEACHING MOTOR SKILLS

By

Jeannette Pruyn Reed

A Thesis
In partial fulfillment of the
Requirements for the Degree of
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The writer is indebted to Elizabeth Westerfield, Principal of the Manzano Day School, Albuquerque, and to the children of the school, for co-operation during the period in which the work on the following study was done.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Although much study has been done in the fields of education and child development, comparatively little investigation has been directed toward the special field of educative rhythms, e. g., the use of rhythms in training the motor skills of young children. It further appears that the utilization of word and rhythm combined in games, dramatization and mechanical exercises has not been adequately related to the physical, emotional and social development of the child. And to the writer's knowledge, there have been no studies to discover the best method of teaching educative rhythms to young children.

The practical application of the special methods of teaching motor skills to young children from the ages of three to twelve, was carried on for nine years in a private day school for approximately 160 children as part of the regular curriculum. The work was concerned with promoting child development through the encouragement of correct habits of moving, by allowing the child to experience success in his playground activities, and in this way minimizing the frustration stemming from physical in-co-ordination. The present study is an attempt to evaluate this work under conditions of better control.

I. THE PROBLEM

Statement of the problem. It was the purpose of the study reported herein to evaluate three different methods of teaching motor skills to young children: (1) the Laissez Faire or minimum instruction method; (2) the addition of a rhythmic nursery song to minimum instruction; and (3) directive speech added in the form of song to concentrate attention and synchronize the action with words describing that action.

Observations by the writer in teaching rhythms to young children in the classroom have produced the opinion that the last named method is the most effective. The experiment reported herein was designed to provide more objective evidence on all three methods.

Importance of the study. The motor skills of children would appear to be not only intrinsically important, in that they relate to a large area of child behavior, but also significant with respect to the overall development of emotional and social reactions or habits, e.g., habits of self-confidence and effective inter-personal contact. It would follow that the methods used to teach such motor skills have value in proportion to the importance of the possible effects of these skills. Thus, any information relevant to the value of different methods is seen to be of considerable practical importance.

More specifically, the aim of obtaining data on the method of directive speech in song form may be justified as per-

A CRASS-CROSS

Statement of the problem. The purposes of the study reported herein to evaluate three different methods of teaching motor skills to young children: (1) the LAZARUS Pair or minimum instruction method; (2) the adaption of a rhythmic nursery song to minimal instruction; and (3) directive speech added to the words of song to coordinate rhythm and synchronize the motion with verbal commands that action.

Observations by the writer in regular nursery school children in the classroom have suggested the spatial direction last named method is the most effective. The experiment reported herein was designed to provide more objective evidence on all three methods.

Importance of the study. The motor skills of children would appear to be not only interesting in themselves, in that they relate to a large area of child behavior, but also sufficient with respect to the overall development of the physical and social relations or habits, e.g., habits of self-confidence and effective inter-personal behavior. It would follow that methods that to teach motor skills have value if they contribute to the importance of the acquisition of these skills. Moreover, any information relevant to the relative effectiveness of methods is seen to be of considerable practical importance.

More specifically, the mix of obtaining data on the method of directive speech in a way that may be helpful to

tinent to the actual and current classroom practice of the writer.

II. DEFINITIONS OF TERMS USED

Synergism. Synergy means co-operation in action. When several muscles function together in the production of a complex act, each muscle contracting at the right time and to the proper extent, this is called a synergism.

Automatism. In psychology the term automatism refers to an habitual action performed without the doer's deliberate control, as when a practiced speaker concentrates his attention on the subject of his speech and trusts to acquired automatisms for its expression.

Educative Rhythms. The term Educative Rhythms is used in the present study to denote a method of teaching rhythms by combining basic motor actions and skills with self-directive songs, the purpose of which is to establish correct habits of moving.

Vocabulary of movement. By vocabulary of movement is meant one's stock or repertory of muscular acts, synergisms, and automatisms.

timent to the actual [illegible] of the [illegible] of the
writer.

II. DEFINITIONS OF TERMS USED

Dynamism. Synergy means co-ordination in action. When several muscles function together as the prehension of a complex act, each muscle contributing its [illegible] share to the whole extent, this is called a synergism.

Automatism. In psychology the term automatism refers to an habitual action, performed without [illegible] deliberate control, as when a pianist [illegible] attention on the mechanics of his [illegible] automatisms for the accompaniment.

Executive Mechanism. The [illegible] in this present study to denote a [illegible] by combining basic motor [illegible] in an [illegible] active manner. The purpose of this [illegible] of moving.

Coordinator of movement. By [illegible] meant one's [illegible] of [illegible] and automatisms.

CHAPTER II

GENERAL DISCUSSION AND REVIEW OF THE LITERATURE

I. NEUROMOTOR DEVELOPMENT

Movement as an index of personality. One of the basic aims of education is the achievement of the highest degree of integration for each individual. Emotional security is indispensable to personality growth. Movement and speech, how one walks, stands, sits, and how one expresses ideas in words are indicators of the level of integration a person has attained. Maturation and practice are continuous from birth. They contribute their share towards the development of the average child, but guided training and conditioning are also important to the growth program, and should be constantly kept in mind.

Motility. Throughout the phylogenetic scale, movement has been of primary importance in the evolution of species. Survival and development of each class has been permitted largely because of the more and more complex "vocabulary" of patterns of movement acquired and required of each group, from the simple approach toward food and safety, and reversal away from danger which we find in the protista,[1] to the complex behavior of man. Motility has implied security from the uni-

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1 Carl J. Warden, Thomas N. Jenkins, Lucien H. Warner, Comparative Psychology, Vol. I (New York: The Ronald Press Company, 1940), pp. 141-162.

cellular level to man. Effective movement would therefore seem to be of vital importance to the individual.

Vocabulary of movement. When a child is born, he already possesses many patterns of movement that fit into the scale of motor development. Gesell,[2] in Developmental Diagnosis, gives us norms and averages for each age level for motor activity and speech developments. It has been emphasized that maturation usually takes place with a time sequence suitable for human needs. Morgan tells us: "We shall be impressed with the fact that motor acts are specific, that different patterns unfold at different times in the life of the child, and that each must be learned in its own way."[3] Each new step results in giving him...a new sense of power and achievement."[4] Thus the child obtains his first degrees of self-sufficiency, adequacy and emotional security.

Co-ordination and muscle synergy. The small child beginning to creep has acquired the ability to co-ordinate his legs, arms and whole body in order to propel himself toward his goal. Gaining upright position and stance is the next step in body control. This act takes much practice. It requires a different muscle combination of synergisms and controls, since it is

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2 Arnold Gesell and Armatruda, Developmental Diagnosis (New York: Paul B. Hoeber, Inc., Harper Brothers, 1948), pp. 3-90.

3 J. B. Morgan, Child Psychology (New York: Rhinehart and Company, 1946), p. 136.

4 Gesell, op. cit., p. 196.

cellular level to man. Kephart's [illegible] concepts seem to be of vital importance to our industrious.

Vocabulary of movement. When a child is born, he already possesses many patterns of movement that fit into the model of motor development. As will, in Gardner's [illegible], give us norms and averages for each age level for motor activity and speech development. It has been conceivable that motor ritual usually takes place when a child experiences frustration from lacking needs. Morgan tells us: "We must be impressed with the fact that motor acts are symbolic, that other-than-pedestrian movements at different times in the life of the child, and that these movements be learned in his own way." Each movement, reaching in crawling, hitting...a new sense of power and motivation. Thus the child obtains his first degrees of self-definition, adequacy and emotional security.

Generalization and equal systems. The ability to generalize by crossed has modified the ability to co-ordinate the legs, arms and whole body in order to accept the [illegible] total environment. Gaining verbal position and [illegible] the child's body, in body control. This act takes much practice. It requires a [illegible] muscle co-ordination of symmetrical and opposite. After it has

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2 Arnold Gesell and [illegible], [illegible] (New York: Paul B. Hoeber, Inc., [illegible], 1949), p. 90.

3 A. S. Morgan, [illegible] (New York: [illegible] and Company, 1954), p. [illegible].

4 Gesell, op. cit., p. [illegible].

more difficult to maintain the equilibrium of a high center of gravity on a small base than on a broad base. The application of the laws of physics to human body movement are explained by Mensendieck[5] in her book on body mechanics and functional exercise. Walking is the next neuromotor combination to be achieved. It demands a transference of body weights from one foot to another in even alternation, in order to propel that body forward through space. The failures are many at first. A side motion or waddle is easier to accomplish. The forward transference often means falls, hurts, tears, and emotional upsets. A problem may result if these unsuccessful attempts occur too frequently and are allowed to continue too long. The child may resort to negative behavior and sit apart. Lazy muscles may result from his unactivity, or he may acquire wrong habits of moving and in so doing, develop pronated ankles an and weak arches. The writer believes that we can prevent many of these unnecessary occurances by knowing when and how to help the child gain proficiency in the synergisms and skills he needs for his play.

Motivation in motor development. Motivation and skilled training are important in order to make body building interesting. Muscles need guided encouragement in order to act correctly. Civilization has minimized many of our gross physical activities, and for this reason it would seem

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5 Bess M. Mensendieck, The Mensendieck System of Functional Exercises. (Portland, Maine: The Southworth-Anthosen Press, 1937), pp. 11-15.

more difficult to maintain equilibrium because of the
center of gravity on a small base of support.
The application of the laws of physics to human move-
ment are explained by Hamerkaemper. In her book on physical
education and therapeutic exercise, training in the
neuromotor coordination is to be achieved. As the child grows
taller of body weight from the legs to overcome the
alternation, in order to develop a sense of rhythm
space. The failures are many as there. A little action or
walk is easier to accomplish. The forward step
often means falls, bruises, and emotional problems.
problem may result in some behavioral disorders
frequently and are slow to continue too long. The child
may resort to negative behavior and fit accept. Any success
may result from his sensitivity, or he may develop
habits of moving and in so doing, develop proper, either or
and weak muscles. The mother held very high expectations
many of these unnecessary experiences by thinking very
to help the child gain proficiency. Proper experience and
skills be made for his play.

Motivation in motor development. Established and
ed training are important in order to make motor
interesting. Muscles need proper exercisement in order
act correctly. Motivation can induce many of our gross
physical activities, and lack of it [illegible]

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5 Hans M. Hamerkaemper, The Physical Education of Children and Exercises. (Portland, Maine: The Southworth-Anthoensen Press, 1947), pp. 11-15.

reasonable to assume that many of our muscles do not have the opportunity and practice to develop the synergistic efficiency that they previously did. Perhaps if more time and guided training were allowed the young child in which to learn and establish correct habits and incorporate them as automatisms in his "vocabulary" of movement, he might minimize the number of frustrating experiences which inevitably occur on the playground and in his early school years. Morgan outlines the effect of motivation and failure: "Several studies have attempted to determine the relative potency of success and failure as incentives to continued effort....It was found that any incentive was more effective than no incentive at all...."[6] Although "no incentive at all" is a hypothetical state, it may be conceded that some conditions may be more effective than others in regards to incentives.

Timing as a factor in the neuromotor developmental schedule. Maturation and successful acquisition of such motor skills as walking, running, jumping, hopping and skipping at certain ages tend to indicate normality. A study of the norms and development of these skills may be found in Gesell's[7] book. Any retardation in the developmental sequence

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6 Morgan, op. cit., pp. 256-257.

7 Gesell, op. cit., pp. 3-90.

may exact a penalty in social growth and later reflect itself to a certain degree in emotional insecurity and instability. For instance, a child of four who learns to skip is praised for his early achievement of this skill. He gains a greater degree of satisfaction from his success than the overgrown child of six who possibly has had insufficient encouragement and guidance in learning motor skills, and who clumsily tries to catch up with his playmates. Gesell[8] discusses retardation in Developmental Diagnosis.

Rhythmic repetition as a factor in motor development. An important factor in muscle development is rhythmic repetition. Throughout the animal kingdom, repetition of movement is evident. Animals appear to include this element in their program of maturation. Lourie,[9] in an article on rhythm and repetition says:

> We have come to think of rhythmic movement as an integral part of almost all processes in the living organism....These rhythmic activities seem at this point to provide a means for helping the infant in its mobilization to achieve control....Probably in the overall picture of their use, the widespread function of the rhythmic motor patterns in children is to express and relieve tension and anxiety....It seems to be more marked in children whose control over motility is less easily developed.

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8 Gesell, ibid., pp. 316-327.

9 Reginald S. Lourie, "The Role of Rhythmic Patterns in Childhood," American Journal of Psychiatry, Vol. 105 (March, 1949), pp. 653-654.

II. SPEECH DEVELOPMENT

Speech and motor development. Speech is a learned neuromotor skill; many physical actions are also learned neuromotor skills. Neither speech nor actions can be perfected without practice and guidance. In the field of speech education and re-education the use of gesture is encouraged as an aid in learning a new word or sound. Van Riper[10] recommends that gesture be used when teaching a new sound or word in order to add a kinesthetic cue and thus facilitate learning, retention and recall.

Word and action combined. The combination of word and action has been used in various ways to encourage rhythm, to establish concepts, and to give cues to habit formation.

Schlieder[11] has employed the use of word and action in teaching rhythm to his students of music improvisation. An emphatic rhythmic gesture combined with strong diaphragmatic vocalization does encourage and help to establish a feeling of rhythmic continuity or phrase feeling; it does not, however, include any idea of physical actions *per se*. The emphasis is on the development of rhythmic feeling, not on that of physical co-ordination and skills.

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10 C. Van Riper, Speech Correction Principles and Methods (New York: Prentice-Hall, Inc., 1947), p. 79.

11 Frederick Schlieder, Lyric Composition Through Improvisation, First Year's Training in Formal Musical Self Expression (New York: C. C. Birchard and Company, 1927) pp.19-25.

Word and action has been used as a remedial technique in the fields of reading, writing, and spelling as advocated and described in Fernald's book:

> The results of our investigation seem to indicate that the various visual and auditory perceptual and associated deficiencies mentioned by Gates, and Monroe, would disappear if the visual and auditory experiences were supplemented by tactual and kinesthetic experiences....
>
> Observations of the behavior of our cases during the learning of reading, spelling, foreign language and other subjects show that the individual is actually making overt movements of the hands, lips, and throat when he is attempting to learn any new thing. In reading, he attempts to form the words or the letters with his hand and vocalize the word or the letters with definite throat, lip, and tongue movements. When this is stopped, the learning process is blocked. In other words, he actually needs to form the word with his hand and vocalize it during the initial learning process....
>
> Points that should be emphasized here are that these very individuals who have failed to learn to read by visual and auditory methods show a spurt of learning as soon as the kinesthetic method is used; that the learning rate is normal or superior, and that the end product is a skill equal to that of individuals who learn by ordinary methods. 12

Again, in the field of remedial spelling, she says, "The visual child tries to picture the word. The auditory child says something to himself that he can write. The kinesthetic child traces the word and so learns to think it in terms of hand movement".

The Word-action or simultaneous writing and speaking method is used by Orton[13] in stuttering and defective speech

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12 Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York: McGraw-Hill Book Company, Inc., 1943), pp. 167-168.

13 Samuel T. Orton, Reading, Writing and Speech Problems in Children (New York: W. W. Norton and Company, Inc., 1937),

cases. The technique is to write in large letters as you speak the word aloud. Van Riper says: "One of the most effective ways of ensuring unilateral motor lead control of speech is that of simultaneous talking-and-writing.... Speech attempt should be sudden and exactly timed with this stroke, without previous rehearsal in whispered or implicit form...." The same technique is used with the vertical board writing for the stuttering problem: "Unilateral control of a bilateral performance is thereby achieved."[14]

III. RHYTHM

Previous use of rhythm. In kindergartens and primary grades rhythm is usually employed in the forms of social singing games and animal imitations or for the purpose of dramatizing an idea or promoting motor activities. Rhythm is used not so much as a means of perfecting a skill, but rather as a method to produce relaxation or physical co-ordination, to release tensions or increase sociability in the children.

Improving efficiency by means of rhythm. During the last war, recorded music was installed in factories in order to increase the workers' efficiency and minimize fatigue. In general it was found that the worker tired less easily and worked more effectively to rhythm than without it. Coleman

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14 Van Riper, op. cit., p. 38.

is quoted as saying in the article by Lourie: "Rhythm of movement is the essential factor in development of endurance and postponement of fatigue."[15]

According to Buswell,[16] rhythm has been influential in improving the rate of progressive eye movements in oral reading. This improvement is also evident in comprehension of material read.

Emotional expression and release through rhythm and action. Rhythmic singing or chanting has been recognized as a part of man's emotional outlet as well as a kinesthetic stimulus to muscle groups in physical activities. Through the medium of dance and chants primitive man has sought to propitiate his tribal gods of rain, fertility, hunt and war. In Greek theater the chorus chanted as it moved in order to emphasize a mood, or release tension. Lourie quotes Darwin as saying: "Emotional expression belongs to rhythmic form."[17]

IV. SPEECH, RHYTHM AND MOVEMENT COMBINED

Word, rhythm and action combined. As far as the writer has been able to discover, no study has as yet been made to evaluate a rhythmic speech and action or directive

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15 Lourie, op. cit., p. 657

16 Guy Thomas Buswell, "Fundamental Reading Habits: A Study of Their Development," (A published monograph) Chicago, Illinois, 1922. p. 92-99.

17 Lourie, op. cit., p. 658.

is quoted as saying in his article by Lorenzo: "Rhythm or movement is the essential factor in development of endurance and postponement of fatigue."[15]

According to Dewey,[16] rhythm has been instrumental in improving the rate of progressive eye movements in oral reading. This improvement is also evident in comprehension of material read.

Emotional expression and rhythmic response in thought and action. Rhythmic singing or chanting has always been a part of man's spiritual quiet as well as a stimulus stimulus to muscle groups in physical activities. Through the medium of dance and chants primitive man sought to propitiate his tribal gods of rain, fertility, hunt and war. In Greek theater the chorus chanted as it moved in order to emphasize a mood, or relate tragedy. Lorenzo[17] quotes as saying: "Emotional expression belongs to rhythm."

IV. Rhythm, Action and Aesthetic Reaction.

Early rhythm and action combined. Little as the writer has been able to discover, no study has yet been made to evaluate a rhythmic speech and action curriculum

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15 Lorenzo, op. cit., p. 647

16 Guy Thomas Buswell, "Fundamental Reading Habits: Study of Their Development," (a mimeographed document) Chicago, Illinois, 1922. p. 2-42.

17 Lorenzo, op. cit., p. 648.

song technique for teaching specific motor skills to young children. "Educative rhythms" is an unexplored field. In rhythms and game books for children, the action and words are often synchronized more or less accidentally, but not as a method of teaching specific movement or muscular synergism. In certain types of physical therapy for cerebral palsied and crippled children a song is used indirectly to encourage a conditioned response, but not to direct a movement or particular action. There are some schools of speech education and re-education that advocate the use of gesture to encourage good habits of speech.

In the work songs of the Southern Negro and of primitive peoples, the word and action are frequently synchronized, as may be seen in Slave Songs of the Georgia Sea Islands, by Lydia Parrish.

> In the old days, before Negroes rode to work in automobiles, they sang as they walked, and most of their tasks were lightened with song....Among the Negroes, any song with the proper rhythm is used to accompany whatever work requires its help....if no suitable verse came to mind for a particular task, one was made up then and there out of slender material." [19]

Children sing as they play. They repeat their singsong over and over again as an accompaniment to what they are doing as if to practice and perfect the action. In the writer's experience, when the word and action are synchronized the

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19 Lydia Parrish, Slave Songs of the Georgia Sea Islands (New York: Creative Age Press, Inc., 1942), pp. 197-198.

child moves with more definiteness, and when the child moves and sings, the words in the song are more articulate and positive.

"Sing-It-and-Do-It" Technique. Because of the lack of literature available in this field, Grace R. Jackson and the writer collaborated in writing a book for small children, Sing It and Do It.[20] The purposes of the book are: (1) to establish correct habits of moving by teaching basic motor skills:[21] to synchronize these movements with descriptive self-directing words in song form: (3) to foster a feeling for rhythm by the use of rhythmic repetition, and (4) to stimulate muscular efficiency through repetition of word and action. Each action is analyzed from the point of view of correct muscle synergism and body mechanics. The Mensendieck analysis of muscle function and body mechanics is used as a basis for correct synergisms.[22]

The following experiment was designed to evaluate the writer's system of teaching basic motor skills as compared with two other methods.

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20 Grace R. Jackson and Jeannette Pruyn Reed, Sing-It-and Do It(Albuquerque: University of New Mexico Press, 1942)

21 By basic motor skills is meant physical actions originating from push, pull, swing and spring; and locomotor skills of walking, running, jumping, hopping and skipping and their combinations.

22 Mensendieck, op. cit., p. 12. (The writer is an authorized teacher of the Mensendieck system of body building and conscious muscle education. She has applied the theory to the physical exercises in the book, Sing It and Do It.)

CHAPTER III

SKILLS, METHODS, MATERIALS AND GROUPS USED

Skills. Three skills were chosen: (1) jumping rope, (2) ball-catching, and (3) ball-throwing. The last two skills wer were selected because they are often used in the developmental scales of children, although, as far as the writer has been able to determine, they have not been taught or used for the same purpose as they were in this experiment. Rope jumping was included because it presents a difficult motor co-ordination involving rhythmic repetition.

The three skills named above were selected specifically because errors could be noted and measured numerically. They were as follows:

1. Jumping a turning rope four times in rhythmic succession.

2. Catching a ball thrown from a distance of eight feet four times in alternated succession.

3. Throwing a ball four times in alternated succession to the experimenter at a distance of eight feet.

Methods used. Three methods of teaching skills were used:

1. Singing a self-directing song simultaneously with the action, hereafter referred to as "Sing-It-and-Do-it" method.

2. Using a rhythm or well known simple song, not

related to the action, while the child was performing the skill, hereafter known as the Rhythm-Only method.

3. No rhythm or song or words were used to co-ordinate the physical action in method three, which will hereafter be known as the Laissez Faire method.

Groups used. A group of eighteen pre-kindergarten children of four to four and one-half years of age were divided into three groups of six children each, in the following manner: all names were place in chronological order. The first three names were placed in a hat. The first name was drawn and placed in group one. The second name drawn was placed in group two. The last name in the hat was placed in group three. This procedure was followed until all of the girls' names had been drawn and placed in three groups. The same procedure was then followed for the boys. As there were fewer boys than there were girls in the group, it was thought best to randomize them separately in order to equalize the sexes as far as possible.

Materials. For skill one, a rope fourteen feet long, and one-half inch in thickness was used. It was tied to a chair at one end and turned by the experimenter at the other. For skills two and three, a rubber ball weighing about one-half a pound and measuring eight inches in diameter was used. It was large enough to be easily caught and thrown by small children.

related to the action, while the skills are practiced, the skill, hereafter known as the Kindergarten method.

3. No rhythm or song or music were used to co-ordinate the physical exercise as seemed desirable with hereafter be known as the Indiana Plays method.

Groups used. A group of eighteen pre-kindergarten children of four to four and one-half years of age were divided into three groups of six children each, in the following manner: all girls were placed in alphabetical order. The first three names were placed in a hat. The first name was drawn and placed in group one. The second name was placed in group two. The third name in the hat was placed in group three. This procedure continued until all of the girls' names had been drawn and placed in these groups. The same procedure was then followed for the boys. There were fewer boys than there were girls in the group. It was thought best to randomize the groups [illegible] because as far as possible.

Materials. For skill one, a type Lawrence rope and one-half inch in diameter was used. It was tied to a chair at one end and tossed by the experimenter. For skills two and three, a rubber ball measuring about one-half a round and measuring [illegible] in diameter was used. It was large enough to be easily caught and thrown by small children.

CHAPTER IV

PROCEDURE FOR LEARNING

Procedure for learning experiment. The children came to the place chosen for the experiment in their own groups, waited in line for their turn, and each child had four trials in the three separate skills on alternating days, three times a week, for four weeks. After the first week of trials, bad weather interfered and Easter vacation intervened. This fact may account for the high number of errors made at the end of the four trials.

An adult helped during the trials and took charge of recording errors. Errors were counted as follows:

a. In skill one if the child failed to jump over the rope in motion, it was counted as a full error. If the child was unable to jump as the rope came around, and the rope had to be slowed up while he jumped, it was counted as half a success only, so that even if he succeeded in jumping four times over the slowed up rope, he was given a score of only two successes and two errors.

b. In skill two, (catching the ball), failure to throw the ball constituted an error.

c. In skill three, (throwing the ball), failure to throw the ball within easy reach of the experimenter, or to throw wildly overhead or on the ground, constituted an error.

CHAPTER IV

PROCEDURES FOR LEARNING

Procedure for Acquiring Self-Effect. The children came to the place chosen for the experiment in their own carriage, waited in line for their turn, and each child had four trials in the three separate skills on alternating days, three times a week, for four weeks. After the first week of trials, bad weather interfered and hardly variation is reported. This fact may account for the high number of errors made in the 2nd of the four trials.

An error is defined during the trials as being guilty of recording errors. Errors were defined as follows:

a. In skill one, if the child failed to jump over the rope in motion, (Error of omission) is a full error. If the child was unable to jump as the rope came around, and the rope had to be slowed up slightly or jumped, it was counted as half a error. So that if one had accomplished in jumping four times over the slowed up rope, he was given a score of only two successes and two errors.

b. In skill two, (catching the ball), failure to throw the ball constituted an error.

c. In skill three, (throwing the ball), failure to throw the ball within any area of the [illegible], or to throw validly overhand or on the attempt, constitutes an error.

PROCEDURE, GROUP ONE, "SING-IT-AND-DO-IT" METHOD

Skill one. The children of the group lined up for a turn and were instructed to sing to the tune of a simple singsong melody as they jumped over the turning rope:

And jump the rope, and jump the rope,
And jump the rope, and jump!

The experimenter sang with them as they performed the skill. The word "jump" synchronized with the turn of the rope and with the child's action of jumping. Complete success was counted when the child jumped four times in rhythmic succession. An outline of the synchronous action of word and rope position is show in Figure I.

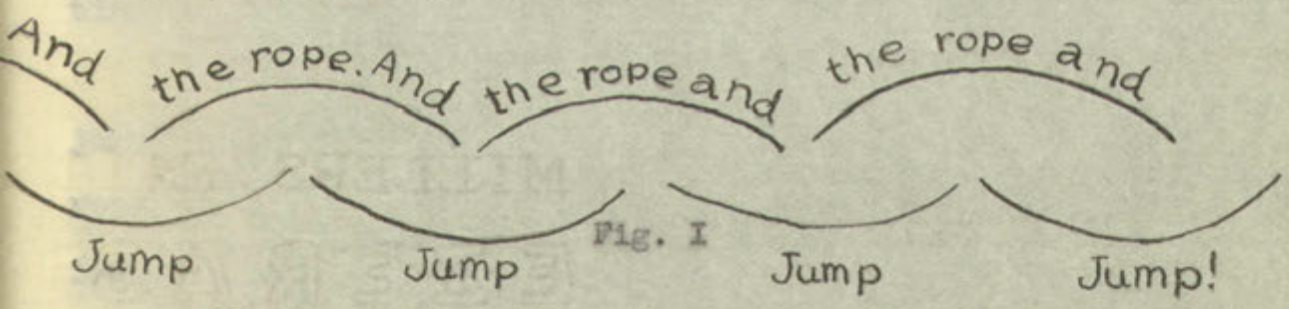

Fig. I

The group of children jumped one after the other until all of them had had their trials for that day.

Skills two and three. Catching and throwing the ball. The child was placed eight feet away from the experimenter and told to catch and then to throw the ball as they both sang:

Swing, swing, catch it, swing, swing, throw it,
Swing, swing, catch it, swing, swing, throw it!

Repeated once.

When the four trials of catching the ball and the four trials

PROCEDURE, GROUP ONE, MIND-BY-MIND-AND-BODY SCHEME

SKILL ONE. The children of the second group were in turn and were instructed to sing to the tune of a simple singsong melody as they jumped over the swinging rope:

And jump the rope, and jump the rope,
And jump the rope, and jump!

The experimenter sang with them so they performed the skill. The word "jump" synchronized with the turns of the rope and with the child's motion of jumping. Complete mastery was counted when the child jumped four times in rhythmic succession. An outline of the synchronous motion of arm and rope position is given in Figure 1.

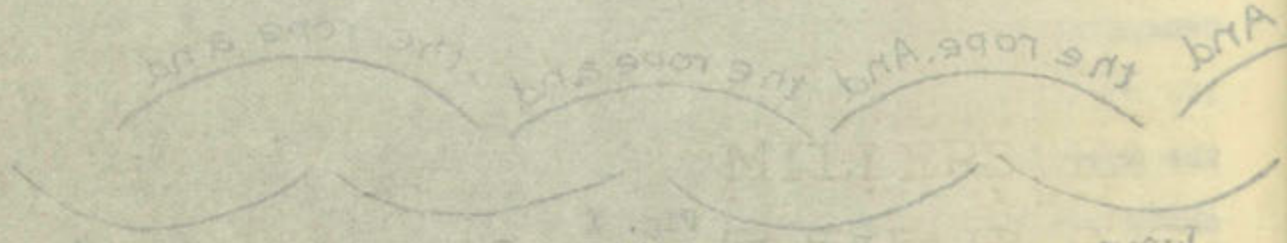

Fig. 1

The group of children jumped one after the other until all of them had had their trials for that day.

SKILL TWO AND THREE. Balancing and Throwing the Ball. The child was placed after first every item by experimenter and told to watch and when he throw the ball up and down saying

Watch, watch, watch it, watch, watch, throw it!
Watch, watch, watch it, watch, watch, catch it!

Then the four trials of balancing and throwing the four balls

of throwing it had been accomplished, throughout the group, the children left the place for that day, and the next group was called in.

PROCEDURE, GROUP TWO, RHYTHM-ONLY METHOD

Skill one. Directions were given by the experimenter for the child to jump over the rope and sing:

> Oh, all around the cobbler's bench
> The monkey chased the weasel,

as he jumped over the turning rope in rhythmic repetition. The experimenter sang with the child. Each child had four jumps to perform in succession as the rope was turned four times to the rhythm of the song.

Errors were counted as in group one. A fault in jumping over the turning rope was counted a full error. If the rope had to be slowed up for the child and he succeeded in jumping it, although not in time to the tune, the trial was counted as half a success and half an error. No words were used to direct the child and the directions were given only at the beginning of the trials.

Skills two and three. The skills of catching and of throwing the ball done by group one were repeated by group two in the following manner. The children were instructed to catch the ball thrown to them by the experimenter from a distance of eight feet. Theye were to sing with her:

Ding-dong bell,	(Child stands and catches the ball on bell).
Pussy's in the well,	(Child swings forward, back, and throws ball on well).
Who put her in?	(Child stands and catches ball on in).
Little Tommy Green!	(Child swings forward, back, and throws ball on Green).

This procedure was repeated once to give each skill four trials.

Errors were counted as in group one. Failure to catch the ball constituted an error in skill two, and failure to throw the ball straight (i.e., close enough for the experimenter to catch it without fast movement over the head or on the ground), constituted a full error in skill three.

PROCEDURE, GROUP THREE, LAISSEZ FAIRE METHOD

Skill one. Group three came into place when group two had left. This group was given no instruction to sing or direct their actions by means of words. At the beginning of the trials for the day they were instructed to jump over the rope as it came around four times in succession. Errors were counted in the same way as they were in the two former groups and methods.

Skills two and three. The children were told to catch the ball when it was thrown by the experimenter from a distance of eight feet. They were shown how to swing forward and back and throw the ball to the experimenter eight feet away. In order to hold their attention, the experimenter said, when occasion

Ding-dong bell, (Child's arms and shoulders are
<u>hung on hook</u>).

Pussy's in the well, (Child drops forward, head
and shoulders hanging <u>down</u>).

Who put her in? (Child straightens and stands
<u>half-erect</u>).

Little Tommy Green! (Child unbends further, head
and shoulders hang <u>down</u>).

This procedure can repeated once or twice each child from begin-
ning.

Games were conducted on Jackson Day, February 8 by
the ball constituting an arrow in which two, or [illegible]
throw the ball against (i.e., close enough for the [illegible]
master to catch it without any barrier over the [illegible]
the ground), constituted a full score in each game.

PROCEDURE, DAILY FORMS, LESSONS & ACTIVITIES

<u>Skill one</u>. Group three boys into pairs and [illegible]
had left. This group was given no instruction in [illegible]
simple motions by means of words. As the [illegible]
for the day they were instructed to jump over the [illegible]
came around four times in succession. Records were [illegible]
the same way as they were [illegible] the [illegible] group [illegible].

<u>Skills two and three</u>. The children were [illegible]
the ball when it was thrown by the [illegible] from a distance
of eight feet. They were shown how to [illegible]
and throw the ball to the [illegible] [illegible]
to hold their attention, the [illegible]

demanded, "Are you ready, Johnny?" Errors were counted in the same way as in the previous two methods.

EXPERIMENT II

PROCEDURE FOR RETENTION

In the fall, after a vacation of four months, the same experiment was repeated under similar conditions, with the exception that there was no helper to assist the experimenter.[23]

The experiment was conducted in order to determine and compare the retention value of the three methods of teaching three motor skills to four-to-five-year-old children.

EXPERIMENT III

PROCEDURE FOR FIRST CHANGE IN METHOD

A further experiment was conducted in order to discover, if possible, whether a change in method would influence the children to a significant degree in terms of improvement of physical co-ordination and diminished error score. Group two was changed to the conditions of group one and given the directions of the "Sing-It-and-Do-It" method. Group three was changed to Rhythm-Only method.

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23 Most of the children in the three groups returned to the school; only one child was missing from groups one and three. Two children were lacking in group two.

demanded, "Are you ready, Johnny?" Should Bob's mood be in the same way as in the previous two matches.

EXPERIMENT II

- INCREASE FOR DEPRESSION

In the fall, after a duration of four months, the experiment was repeated using similar-aptitude, with the exception that there was an effort to weight the experiment.

The experiment was conducted in order to determine if compare the retention ability of the three groups of students these motor skills to "sure-to-be-in-training".

EXPERIMENT III

- MODERATE FOR PERFORMANCE IN SCHOOL

A further experiment was conducted in order to observe, if possible, whether a change in mental attitude of the children to a significant degree in terms of improvement of physical co-ordination and individual motor skills. Thus the was changed in the conditions of groups one and three directions of the "Sure-I-am-in-it" group. Group two changed to Fun-the-only-way.

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[1] Most of the children in the three groups attended to the school; only one only was absent from groups one and three. The children were limited in ages.

EXPERIMENT IV

PROCEDURE FOR SECOND CHANGE IN METHOD

It seemed of further interest to discover whether a second change in methods would give any added indication of greater success in using the "Sing-It-and-Do-It" method. Therefore, group three, which had had the Rhythm-Only method added to the Laissez Faire method, was now given the "Sing-It-and-Do-It" instructions. The group had improved somewhat with the Rhythm-Only method. This fact might or might not be the result of practice and maturation. In order to discover whether further immediate improvement would occur if the "Sing-It-and-Do-It" method were used in a last test on group three, that technique was added.

CHAPTER V

RESULTS OF THE EXPERIMENTS

Explanation of Tables. The detailed results for the individual subjects for each experimental condition are given in the appendix. Table I gives the error score for the separate trials and skills for the group which learned by the "Sing-It-and-Do-It" method. Thus, subject 1 made 4 errors on the first trial in the rope skipping and a total of 36 errors in all 12 trials. All six subjects made a total of 16 errors on the first trial rope jumping, resulting in a mean of 2 2/3 errors for the first trial. The total number of errors made by the whole group in rope jumping was 108.

Similarly Table II gives the detailed results for the group which learned by the Rhythm method and Table III by the Laissez Faire method. Tables IV, V, and VI give the same details for the retention tests four months later, for the three groups.

Table VII gives results for the Rhythm-Only group which was changed to the "Sing-It-and-Do-It" method, and Table VIII gives the results for the group which was changed similarly from the Laissez Faire to the Rhythm method after the retention tests were completed.

Finally, Table IX gives the detailed results obtained when the Laissez Faire group, which had previously been changed to the Rhythm method, results of which are given in Table VII,

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Finally, Table IX gives the detailed results obtained when the Laissez Faire group, which had previously been changed to the Rhythm method, results of which are given in Table VII,

was changed again, to the "Sing-It-and-Do-It" method.

Explanation of Graphs. Graphs of the mean results given in Tables I-IX in the Appendix are shown in Figures 2--5. Figures 2, 3, and 4 show the results for the separate skills, and Figure 5 is a composite for all three skills combined. In all figures, trials are shown on the abscissa and errors on the ordinate. The base line is divided into four sections showing respectively, from left to right, the results for original learning, retention, first change in methods in which the Rhythm-Only group adopted the "Sing-It-and-Do-It" method and the Laissez Faire group the Rhythm-Only method, and a second change in which the Laissez Faire group, which was previously changed to the Rhythm-Only method was finally put on the "Sing-It-and-Do-It" method.

It will be seen in Fig. 2 that there is a real distinction in learning rope jumping between the "Sing-It-and-Do-It" group and the other two groups. This distinction holds for the retention period. On the other hand, the other two groups have very similar records in retention for this skill. However, when the Rhythm-Only group is changed to the"Sing-It-and-Do-It" method there is a sharp drop in its errors, as compared to the Laissez Faire group which changed to the Rhythm-Only method (Fig. 2, Section 3, labelled as first change). Again, in the second change, there was a sharp drop in errors for the Laissez Faire group when it adopted the "Sing-It-and-

was changed again, to the "Sing-and-Do-It" method.

Explanation of Results. Results of the main analysis given in Tables I-IX in the Appendix are shown in Figures 2-5. Figures 2, 3, and 4 show the results for Experiments I, II, and III. Figure 5 is a composite for all three trials combined. In each figure, trials are shown on the abscissa and errors on the ordinate. The base line is divided into learning sections corresponding respectively, from left to right, the "Sing-Do-Sing" learning, relearning, first change in methods to the Rhythm-only group, second change to the Sing-It-and-Do-It method, the latency period, and a second change in which the Rhythm-only group, which was originally changed to the Rhythm-only method, was finally put on the "Sing-It-and-Do-It" method.

It will be seen in Fig. 2 that there is a great elimination in learning rate during the latency period for the "Sing-It-and-Do-It" group and the other two groups. This elimination begins for the relearning period, on the other hand, the three groups have very similar records in relearning, as they should. However, when the Rhythm-only group is changed to the "Sing-It-and-Do-It" method there is a sharp drop in the errors, as compared to the Latency Fair group which continued on the Rhythm-only method (Fig. 2, section 3, labelled as first change). Again, in the second change, there was a sharp drop in errors for the Latency Fair group when it changed from "Sing-It-and-

Do-It" method.

The differences are less striking for the other two skills but the trends hold (Figures 3 and 4). The distinctions are perhaps sharper for ball tossing (Fig. 4) than for ball catching (Fig. 3). The composite curve (Fig. 5) brings out the distinctions which were tested for significance by analysis of variance (see next section).

These differences (in the learning section) between all three groups are significant at the 5% level or better. However, there is not a significant difference between two of the groups (Rhythm-Only and Laissez Faire) in the retention section, and the close proximity of the two curves in this section is evident. Changing the methods, on the other hand, did give a significant difference and this difference is indicated in the third section by a distinct separation in the two curves. Finally, the last section showed a further improvement when the "Sing-It-and-Do-It" method was adopted. The significance of this improvement cannot be determined because there was no group with which to compare this last section. It adds evidence, conclusive in itself, that within the limits of our testing program, the "Sing-It-and-Do-It" method produces a real improvement in performance whenever it is introduced.

Care should be exercised in concluding that improvements may have been altogether due to changes in method. It could be argued that the improvement was obtained from the

Do-Ist method.

The differences are less striking for the other [illegible] skills but the trends hold (Figures 5 and 6). The distributions are perhaps sharper for spell-check (Fig. 4) than for spell-checking (Fig. 3). The response curve (Fig. 4) begins and ends distinctly; both were nearly [illegible] for subjects if we ventured (see next section).

These differences (in the learning curves) between all three groups are significant at the .01 level or better. However there is not a significant difference between [illegible] (Rhythm-Only and Learner Paced) in the end-point [illegible], and the close proximity of the [illegible] curves in this section is evident. Changing the methods, on the other hand, displays a significant difference and this difference is indicated in the [illegible] section by a distinct separation in the two curves. Finally, the last section showed a further improvement when the "Step-Is-and-Do-Is" method was adopted. The significance of this improvement cannot be determined because there was no [illegible] with which to compare this last section. It also should, [illegible] in itself, that within the limits of our [illegible], the "Step-Is-and-Do-Is" method [illegible] improved the performance whenever it is introduced.

Care should be exercised in generalizing these experiments may have been [illegible] such as to discourage [illegible]. It could be argued that the [illegible] and [illegible] were too

continuance of practice or maturational development of the children. However, it can also be noted that the changes were greatest when the word was added, as compared to adding Rhythm-Only in all three skills.

The question can be raised as to whether these differences are significant or not. This experiment was outlined somewhat after the factorial design described by Fisher.[24] It would be convenient if the data could have employed one overall n analysis of variance to determine the significance of the various results contained in the study. However, there are several reasons why this cannot be done without violating some of the assumptions required for such an analysis. These assumptions include (1) homogeniety of variance, (2) additivity of effects, and (3) correlation of the deviations with the main variables.

1. Homogeneity of Variance. Homogeneity of variance requires that the variances concerning any one criterion shall not be so different that the chances are small that they could have come from the same population. Usually the L_1 test is used to establish homogeniety but this is frequently a long and tedious process to carry out. It is often possible to tell from inspection that homogeniety is not likely. Thus, in our instance, under Method I, Skill I for learning, subject 1 made

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26 R. A. Fisher, The Design of Experiment (London: Oliver and Boid, 1947), pp. 88-103.

continuance of practice or instructional development of the children. However, it can also be argued that the change is greatest when the [illegible] was weakest, as corrected by drilling rhythm-only in all three skills.

The question can be raised as to whether Gestaltists-whose are significant or not. This experiment was repeated somewhat after the technical design described by Ribbon. It would be convenient if this data could be employed one dropped a analysis of variance to determine the significance of the various results obtained in detail. Further, there are several reasons why this cannot be done without violating some of the assumptions upon which the analysis, these assumptions include (1) independence of errors, (2) additivity of effects, and (3) correlation of the dependent variables variables.

1. Homogeneity of variance. Homogeneity of variance requires that the variance corresponding any one cell/ not be so different than the others are such that one could have done from the same population. Having the 1, 2 and 3 need to establish homogeneity but only in terms of a line and tedious process to carry out. It is often possible [illegible] from inspection that homogeneity is not right. Then, in this instance, under Method 2, Skill 1 for learning [illegible] 1 mode

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26 R. A. Fisher, The Design of Experiments (Edinburgh: Oliver and Boyd, 1947), pp. 98-113.

36 errors, varying from 2 to 4 on successive trials while subject 6 made only 3 errors with no more than 1 on any one trial.

It might be argued that the selection of two extremes from a large sample would lead one to expect differences beyond the 1% level of significance. However, homogeniety is among our lesser worries. If the other assumptions were fulfilled it might be possible to employ a transformation which would fulfill the requirement of homogeniety for our scores.

2. Additivity of effects. The equation for analysis of variance indicates that the factors isolated for study add together to give the total variance. The use of ratios indicates multiplication and division. They are suspect when utilized for analysis of variance. This difficulty arose in analysing the data. Thus three skills were involved, rope jumping, ball tossing and ball catching. They are probably of unequal difficulty, as reflected in the method of scoring, and an error in one skill is not necessarily the equivalent to that of another skill.

In an agricultural study, one would not measure one crop in terms of bushels and another in terms of dollars. While errors in different skills all sound alike, the situation is somewhat comparable. At any rate, an error in one skill is only roughly comparable to that in another. One

36 errors, varying from 2 to 4 on successive trials; subject 6 made only 3 errors with an intervening 6 on any one trial.

It might be argued that the selection of the errors from a large sample would have one to expect differences beyond the 1% level of significance. However, frequently in among our lesser vertebrates, if the other assumptions were fulfilled it might be possible to employ a transformation which would unfold the [illegible] of these differences to scores.

3. Adaptivity of errors. The variation [illegible] of variance indicates that the factors [illegible] together to give the total variance. The use of matrix [illegible] multivariate analysis. Most one-factor [illegible] utilized for analysis of variance. The difficulty arises in analyzing the data. Some [illegible] are [illegible], [illegible], hail breaking and hail [illegible]. They are [illegible] of unequal difficulty, as reflected in the [illegible] of [illegible], and an error in one skill is not necessarily the equivalent to that of another skill.

In an experimental study, one would [illegible] group in terms of [illegible] and [illegible] [illegible]. While errors in different skills are equally [illegible], the situation is somewhat comparable. At any rate, an error in one skill is only roughly comparable to [illegible] in another. The

thinks of using standard scores, as Coy[27] did in her unpublished study, but she did not justify the procedure.

If standard scores had been utilized ratios would have been employed and these involved multiplication and division which in turn might effect the requirement for additivity. On the other hand, if the skills are treated separately, with a separate analysis of variance for each, along with further divisions of the data with respect to other assumptions required for the rigorous use of the method, the separate segments of the study become so small with corresponding reduction in the number of degrees of freedom that very large differences are necessary to establish significance. Therefore, it was decided to assume that the errors of the different skills were comparable but to recognize that, this assumption was subject to criticism. Since only four errors for each skill could be made for each subject on each trial, this is roughly true and the assumption of comparability for errors in different skills is not extreme.

3. Correlation of the deviations with the main variables. From the standpoint of our study, the most serious requirement and the one which gives the greatest difficulty

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27 Jim Mae Coy, "Standardization of the Bradley Tests and the Effects of Hypoglycemia on One Subject's Scores," (unpublished Master's thesis, The University of New Mexico, Albuquerque, 1947).

thinks of using standard scores, on Day [illegible] per[illegible]-
lished study, but she did not [illegible] [illegible] procedure.

If standard scores had been utilized [illegible] and/or
have been employed and those involved multiple [illegible] and
division which in turn might affect the requirement for
additivity. On the other hand, if the [illegible] are treated
separately, with a separate analysis of variance for each,
along with further division of the [illegible] [illegible] [illegible]
other assumptions required for the [illegible] [illegible]
method, the separate aspects of the [illegible] [illegible] [illegible]
with corresponding reduction in the number of degrees of
freedom that very large differences are required to [illegible]
[illegible] significance. Therefore, if one decides to assume [illegible]
the errors of the different scales are [illegible] and to
recognize that this assumption was violated to [illegible] [illegible]
since only four errors for each scale [illegible] [illegible] for each
subject on each trial, this is [illegible] [illegible] [illegible] [illegible]
tion of comparability for errors in different scales is not
extreme.

3. Correlation of the variables was low [illegible] [illegible]
[illegible]. From the standpoint of our study, the [illegible] [illegible]
requirement and the one which gives the [illegible] [illegible]

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[27] Jim Dee Coy, "The [illegible] of the [illegible] [illegible]
and the Effects of Hypnotic Induction on the Subjects' Scores," [illegible]
(unpublished Master's thesis, The University of New Mexico,
Albuquerque, 1967).

is the assumption that the deviations do not correlate with the main variables. This will always give difficulty where analysis of variance is employed in learning or retention studies. Eisenhart[28] and Cochran[29] have described the problem in general, and Kogan[30] has considered it with reference to learning experiments. Apparently, the employment of the same individual over again in successive trials introduces a subtle correlation from one trial to another which serves to inflate (?) the error term and possibly has other effects that vitiate its use in dertermining the significance of the results for different methods, skills, trials, subjects, etc. Kogan sought proper interactions to use in testing the significance of the main variables, but was not wholly convinced that his solution was rigorous.

Only expert statisticians could be expected to reach a solution to such problems. One can only try to avoid the pitfalls they point out. In this instance, it consists of not running an analysis of Variance which separates out the variance due to trials and determining its significance. Rather, the results of the separate trials for learning were lumped by summing, which is the same as assuming that there

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28 Churchill Eisenhart, "The Assumptions Underlying the Analysis of Variance," Biometrics, Vol. 13, March, 1947.

29 W. G. Cochran, "Some Consequences when the Assumptions for the Analysis of Variance are not Satisfied," Biometrics, Vol. 3, No. 1, March, 1947.

30 Leonard S. Kogan, "Analysis of Variance -"Repeated Measurements," Psychological Bulletin, Vol. 45, No. 2, March, 1948, pp. 131-143.

is the assumption that the deviations do not correlate with the main variables. This will always give different answers analysis of variance is applied to learning or research studies. Blackhart[28] and Gardner[29] have demonstrated the problem in general, and Hogan[30] has pointed out its serious relevance to learning experiments. Accordingly, the analyst of the data should individual over again in successive trials. Sometimes a subtle correlation from one trial to another may result in indicate (2) the error term and correspondingly the power of the that utilize its use in determining the significance of the results for different methods, trials, trials, subjects, etc. Hogan sought proper observations to use in testing the significance of the main variables, but he also clearly pointed that this analysis was erroneous.

Only expert statisticians could be expected to arrive a solution to such problems. The certainly say to correct the statistic any point out. In this instance, it could be advisable running an analysis of variance which among the two variances one is trials and dependently the significance. Rather, the results of the analysis should be checked by using, which is not seen as a trial, using these

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[28] Gardner Blackhart, "The Assumptions in Analyzing the Analysis of Variance," Biometrics, Vol. 13, March, 1957.

[29] W. G. Cochran, "Some Consequences when the Assumptions for the Analysis of Variance Not Satisfied," Biometrics, Vol. 3, No. 1, March, 1947.

[30] Leonard S. Hogan, "Analysis of Variance - Models and Measurements," Psychological Bulletin, Vol. 54, No. 2, March, 1957, pp. 171-172.

had been one long learning trial lasting over several days, The same was done for retention, and likewise for changes in method, carried out after the retention tests were given.

Furthermore, it is not possible to compare the learning with the retention results, or either of these with the results obtained when change in method was instituted, for the same correlation problem enters here. Such differences can only be suggested without determination of significance, from inspection of the curves. It is recognized that any obvious difference could be due to the further practice given in obtaining it, or, if the lapse of time is great, to maturation rather than to change of method, and that only further investigation with larger numbers of subjects can determine whether practice or maturation could be the responsible factors for the results obtained. Nevertheless, these results do suggest that the methods are effective, and, in so far as the other assumptions do no violence to this data, that methods are in other instances significant and could be expected to play a similar role where change in method is invoked.

Analysis of Variance for the Results of Learning. With six subjects in each of our groups for three methods and for each of three skills, there are 6 x 3 x 3 or 54 observations and 53 degrees of freedom for learning. The analysis of

variance for these results is given in Table 1.

Table 1

ANALYSIS OF VARIANCE FOR THE RESULTS IN LEARNING

Source	Sum of Squares	d.f.	Mean Squares	F
Total	4357	53		
Methods	822	2	411	11.74***
Skills	1684	2	842	24.00***
Methods x Skills	94	4	24	
Interaction Subjects	709.6	15	47	1.35
Remainder	1047	30	35	

Significant differences at the 0.1% level of confidence are found for both methods and skills. Other differences, including the interaction of these two primary factors, are non-significant. Our main interest is in methods. To find which methods were superior, the value obtained from the equation for the fiducial limits for sums was compared to the differences found between the sums for each method. This Equation is:

$$\ell = \sqrt{2NFV}$$

Where N = Number of cases in each sum.
F = Tabled value of F for the proper degrees of freedom at the chosen level of confidence.
And V = Variance of the estimate of error.

variance for these means is given in Table 1.

TABLE 1

ANALYSIS OF VARIANCE FOR THE SCORES IN TEST 1

Source	Sum of Squares	d.f.	Mean Square	F
Total	4937	47		
Methods	322	2	161	1.4
Skills	1088	2	[illegible]	[illegible]
Methods x Skills	[illegible]	[illegible]	[illegible]	[illegible]
Interaction	[illegible]	[illegible]	[illegible]	[illegible]
Subjects	709.5	15	[illegible]	[illegible]
Remainder	1047	30	[illegible]	

Significant differences at the 0.1% level of confidence are found for both methods and skills. Other differences, including the interaction of these two primary factors, are not significant. Our main interest is in methods. In this study methods were superior, the value obtained from the control is for the fiducial limits for mean and consequently the differences found between the three instruction methods. This hypothesis is:

$$\mu = \frac{\sqrt{NV}}{t}$$

where N = Number of cases in each row.
t = Tabled value of t for the degree of freedom of the control.
And V = Variance of the methods as shown.

Substituting in this equation, we find that differences in sums of methods have to be greater than 129 to be significant at the 0.1% level, 97 to be significant at the 1% level, and 73 to be significant at the 5% level. The sum of the errors for the "Sing-It-and-Do-It" method and the Laissez Faire method is thus 152 and is significant at the 0.1% level. The difference between the Rhythm-Only method and the "Sing-It-and-Do-It" method is 86, and between the Rhythm-Only method and Laissez Faire method is also 86. These differences are therefore significant only at the 5% level. From this it can be concluded that the "Sing-It-and-Do-It" method is significantly superior to the other two methods in learning these three acts of skill.

Analysis of Variance for Results on Retention. As one child from each of groups one and three, and two children from group two were missing four months later, the number of observations for retention were 2 x 5 x 3 + 4 x 3 or 42, giving 41 degrees of freedom. The analysis of variance for these results are given in Table 2. Again, the same two primary factors are the only ones that are significant. Applying here the same procedure for fiducial limits to find which methods differences are significant, the values must exceed 86, 64, and 47 for the 0.1%, 1%, and 5% levels respect-

Substituting in this equation, we find the differences in means of methods have to be greater than 1.15 to be significant at the 0.1% level, 97 to be significant at the 1% level, and 73 to be significant at the 5% level. The sum of the errors for the "Ring-It-and-Do-It" method and the Lecture-Drill method in this 1.52 and is significant at the 0.1% level. The difference between the Ring-Only method and the "Ring-It-and-Do-It" method lacks, and between the Ring-Only method and Lecture-Drill method is also 38. These differences are therefore significant only at the 5% level. From this it can be concluded that the "Ring-It-and-Do-It" method is significantly superior to the other two methods in learning these three sets of skill.

Analysis of Variance for Learning on Retention. As one child from each of groups one and three, one from group two and two from group four were missing from retention data, the analysis of observations for learning was made for 4 x 4 = 16 cells, giving 31 degrees of freedom. The analysis of variance for these results are given in Table 2. Again, the same two primary factors are the only ones that are significant. Applying here the same procedure for finding levels at which methods differences are significant, the results were exceed 86, 64, and 47 for the 0.1%, 1%, and 5% levels respec-

ively, when N=27, and must exceed 91, 67, and 50 when N=30.

Table 2

ANALYSIS OF VARIANCE FOR THE RESULTS ON RETENTION

Source	Sum of Squares	d.f.	Mean Square	F
Total	1538	41		
Methods	370	2	185	9.73***
Skills	424	2	212	11.16***
Methods x Skills	95	4	24	1.1
Interaction Subjects	221	11	20	.9
Remainder	428	22	19	.8

The difference between the "Sing-It-and-Do-It" method and the Laissez Faire method is 76 which exceeds the required value of 67 at the 1% level. The difference between the "Sing-It-and-Do-It" and the Rhythm-Only method is 64 which is barely short of the 1% level where the required difference is 64 when the value of N changes to 27 because of fewer cases in the Rhythm-Only group. The difference between the Rhythm-Only method and the Laissez Faire method which is only 12, is not significant. Again we find the "Sing-It-and-Do-It" method superior for these three skills for the retention period. The lack of significance for the Rhythm-Only and Laissez Faire

ively, when $k=17$, and that errors of .07, and 50 degs $k=20$.

TABLE 2

ANALYSIS OF VARIANCE FOR THE DATA ON SLOPE-TIME

Source	Sum of Squares	d.f.	Mean Square	F
Total	1293	41		
Methods	273	2	136	3.0[illegible]
Skills	1,[illegible]	[illegible]	[illegible]	11.1[illegible]
Methods x Skills	[illegible]	4	[illegible]	1.1
Interaction Subjects	[illegible]	21	30	.9
Remainder	448	12	37	.4

The difference between the "Slope-Is-and-Ks-Is" method and the Latinsen Calculator is not quite so striking: a value of 67 at the 1% level. The difference between the "Slope-Is-and-Ks-Is" and the Rhythm-Only method is 6.4, which is barely short of the 1% level with a two-sided difference, is so when the value of k changes to 37 instead of these found in the Rhythm-Only group. The difference between the Rhythm-Only method and the Latinsen Calc method is not even 1% as significant. Again we find the "Slope-Is-and-Ks-Is" method superior for these three skills for the criterion involved. Lack of significance for the Rhythm-Only and Latinsen Calc

methods is born out by inspection of the graphs for retention.

Analysis of Variance for the Results in First Change in Method. There are only two groups to compare when the methods are changed, namely the Rhythm-Only and Laissez Faire groups. The number of observations for this analysis were 4 x 3, and 5 x 3, or 27 observations and 26 degrees of freedom for the first change in Method. Analysis of variance of these results are shown in Table 3, and indicates significance only at the 5% level for methods.

Table 3

ANALYSIS OF VARIANCE

ON

THREE METHODS OF TEACHING THREE SKILLS

FIRST CHANGE IN METHOD

Source	Sum of Squares	d.f.	Mean Square	F
Total	1023	26		
Methods	213	1	213	5.6*
Skills	74	2	37	
Methods x Skills	109	2	54.	1.4
Interaction Subjects	393	7	56.	1.49
Remainder	531	14	38	

methods is born out by Anderson as of two groups for analysis.

Analysis of variance for two groups of which groups in Method. There are only two groups to compare when the methods are changed, namely, the Kuder-Duty and the Fair groups. The number of observations for the analysis were 4 x 3, and 5 x 3, or 27 observations and 26 degrees of freedom for the first chapter in Method. Analysis of variance of these results are shown in Table 1 for Individual analysis only as follows:

ANALYSIS OF VARIANCE

OF

TWENTY PERSONS OF TAKING TWENTY ACTIVITY

FIRST DEGREE IN METHOD

Source	Sum of Squares	d.f.	Mean Square	V
Total	4023	26		
Methods	32			3.85*
Skills	94			.97
Methods x Skills	109			1.4
Interaction Subjects	393	7		.49
Remainder	3[illegible]	4[illegible]	[illegible]	

Again, applying the same procedure for fiducial limits, a value of 68 is obtained. The difference between the two groups is 90 which is beyond the 5% level of significance. In the retention test, the two groups were not significantly different but the change in method to "Sing-It-and-Do-It" produces a somewhat significant difference.

It would be idle to compute the significance of results produced by the change in method from Rhythm-Only to "Sing-It-and-Do-It". The same difficulty regarding correlations applies here as was previously mentioned in our introduction to analysis of variance. Furthermore, the children received more practice when the new method was introduced. Likewise, the significance of the change produced in the Laissez Faire group when it used the "Sing-It-and-Do-It" method rather than the Rhythm method cannot be determined because of the correlation difficulty. The graphs, however, indicate a definite drop for these groups under the changed conditions. It is possible that their improvement was due to further practice and also they may have developed more in the maturation sense. However, when all the lines of evidence are drawn together, there is a strong indication that the "Sing-It-and-Do-It" method is one important influence in producing the differences obtained in this study.

Again, applying the same procedure for Pictorial Limits, a value of 68 is obtained. The difference between the two groups is 20 which is beyond the 5% level of significance. In the retention test, the two groups were not significantly different but the change in method to "Sing-It-and-Do-It" produces a noticeable significant difference.

It would be idle to compute the significance of results produced by the change in method from Rhythm-only to "Sing-It-and-Do-It". The same difficulty regarding correlations applies here as was previously mentioned in our introduction to analysis of variance. Furthermore, the children received more practice when the new method was introduced. Likewise, the significance of the change produced in the Lisson Falls group when it used the "Sing-It-and-Do-It" method rather than the Rhythm method cannot be determined because of the correlation difficulty. The graphs, however, indicates definite drop for these groups under the changed conditions. It is possible that their improvement was due to further practice and also they may have developed more in the maturation sense. However, when all the lines of evidence are drawn together, there is a strong indication that the "Sing-It-and-Do-It" method is one important influence in producing the difference obtained in this study.

CHAPTER VI

SUMMARY AND CONCLUSION

Summary. Three methods of teaching motor skills were applied to three randomized groups of six children each, four to five years of age. The skills chosen were rope jumping, ball catching and ball tossing. The three methods used were; (1) singing a self-directing song simultaneously with the action, or the "Sing-It-and-Do-It" method; (2) singing a rhythm or well-known simple song not related to the action while the child was performing the skill, or the Rhythm-Only method; and (3) no rhythm or song or words to co-ordinate the physical action, known as the Laissez Faire method. Each child had four trials on every skill, three times a week on alternating days for twelve trials. Errors were counted in each skill when the child failed to perform the act at the right time.

Four months later the same experiment was repeated for retention. A first change in method followed in which the Laissez Faire group was changed to the Rhythm-Only method and the Rhythm-Only group was given the "Sing-It-and-Do-It" method. A second change in method was tried and the Laissez Faire group which had previously been changed to the Rhythm-Only method, was now given the directive word or "Sing-It-and-Do-It" method. The results of the first three

experiments were subjected to analysis of variance.

In general, it was found that the "Sing-It-and-Do-It" method was superior in all three skills in learning. In retention the same trend was maintained in rope jumping. Less difference was noticeable between the Rhythm-Only group and the Laissez Faire group in ball catching and tossing. However, when the Rhythm-Only group was changed to the "Sing-It-and-Do-It" method in the first change in method there is definitely improvement over the Rhythm-Only method in all three skills. Likewise, when the Laissez Faire group which had been changed to the Rhythm-Only method and then were instructed to use the "Sing-It-and-Do-It" method, the change was again in the favor of the directive word.

Conclusions. (1) Within the limits of this study we may conclude that the "Sing-It-and-Do-It" method of teaching motor skills to children is superior to the other two methods tested. (2) More generally, it might be concluded that the "Sing-It-and-Do-It" method improves physical co-ordination, and by facilitating the acquisition of motor skills it may indirectly encourage emotional stability in the young child.

experiments were subjected to analysis of variance.

In general, it was found that the "Sing-It-and-Do-It" method was superior in all three skills in learning. In retention the same trend was maintained in rope jumping. Less difference was noticeable between the Rhythm-Only group and the Listen Fair group in ball catching and tossing. However, when the Rhythm-Only group was changed to the "Sing-It-and-Do-It" method in the first change in method there is definite improvement over the Rhythm-Only method in all three skills. Likewise, when the Listen Fair group which had been changed to the Rhythm-Only method and then were instructed to use the "Sing-It-and-Do-It" method, the change was again in the direction of the directive word.

Conclusions. (1) Within the limits of this study we may conclude that the "Sing-It-and-Do-It" method of teaching motor skills is superior in speed to the other two methods tested. (2) More generally, it might be concluded that the "Sing-It-and-Do-It" method improves physical co-ordination, and by facilitating the acquisition of motor skills it may indirectly encourage emotional stability in the young child.

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APPENDIX

TABLE I

GROUP I, "SING-IT-AND-DO-IT" METHOD

LEARNING

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
1	4	4	4	4	4	4	2	2	2	2	2	2	36
2	1	1	0	2	0	0	2	1	0	0	0	0	7
3	3	4	3	2	1	1	1	1	1	1	1	2	20
4	4	3	4	3	2	2	4	4	2	2	0	0	30
5	3	0	2	2	1	0	2	0	0	1	0	1	12
6	1	1	0	0	0	0	0	0	0	0	0	1	3
Σ	16	13	13	13	8	7	10	8	5	6	3	6	ΣΣ108
$\bar{X}$	2.67	2.17	2.17	2.17	1.33	1.17	1.67	1.33	.83	1	5	1	
SKILL II: BALL CATCHING													
1	2	1	4	2	2	1	3	1	0	0	1	0	17
2	0	0	1	2	2	1	0	0	3	2	1	1	13
3	0	0	4	0	0	1	1	1	1	2	1	1	12
4	1	0	1	0	0	0	1	1	1	0	0	0	6
5	2	1	2	1	2	2	1	1	2	0	0	1	15
6	3	1	3	1	1	0	1	0	1	0	0	1	12
Σ	8	3	15	6	7	5	7	4	8	4	3	5	ΣΣ75
$\bar{X}$	1.33	.5	2.5	1	1.17	.83	1.17	.67	1.33	.67	.5	.83	
SKILL III: BALL TOSSING													
11	0	0	1	2	0	1	1	0	0	0	0	0	5
2	1	0	0	1	2	0	0	0	1	1	1	0	7
3	0	1	1	1	0	0	0	1	1	1	0	0	6
4	1	0	1	0	0	0	1	0	0	0	0	0	3
5	2	2	3	2	2	3	3	1	2	0	0	1	21
6	0	0	0	1	0	0	1	0	0	0	0	0	2
Σ	4	3	6	7	4	4	6	2	4	2	1	1	ΣΣ44
$\bar{X}$	.67	.5	1	1.17	.67	.67	1	.33	.67	.33	.17	.17	

TABLE II

GROUP II, RHYTHM-ONLY METHOD

LEARNING

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
7	4	2	4	4	2	2	2	2	2	2	2	2	30
8	2	2	2	2	2	2	2	2	2	2	2	0	24
9	4	3	2	3	2	2	2	2	2	2	2	3	29
10	4	4	4	3	2	4	4	2	2	0	1	1	31
11	3	2	3	2	2	2	2	2	2	3	2	2	22
12	4	4	4	3	3	1	0	0	1	0	1	2	23
Σ	21	17	19	17	13	13	12	10	11	9	10	10	$\Sigma\Sigma$ 163
$\bar{X}$	3.5	2.83	3.16	2.83	2.17	2.17	2	1.67	1.83	1.5	1.67	1.67	
SKILL II: BALL CATCHING													
7	0	1	0	1	2	2	2	0	0	1	1	1	11
8	0	2	4	1	0	1	1	0	1	1	0	1	12
9	0	1	4	1	0	0	0	0	0	2	2	2	13
10	1	2	2	3	2	2	0	1	2	1	1	1	18
11	1	0	1	0	0	0	1	0	3	4	2	1	13
12	1	2	3	1	2	2	1	1	1	0	1	1	16
Σ	3	8	14	7	7	7	5	2	7	9	7	7	$\Sigma\Sigma$ 83
$\bar{X}$	.5	1.33	2.33	1.17	1.17	1.17	.83	.33	1.17	1.5	1.17	1.17	
SKILL III: BALL TOSSING													
7	1	0	0	0	1	1	2	0	1	1	1	1	9
8	0	0	3	1	2	0	0	0	0	0	0	0	6
9	1	2	2	1	0	0	0	2	0	1	2	1	12
10	1	1	3	4	2	0	1	1	1	1	0	1	16
11	0	1	1	2	1	1	0	1	1	2	1	3	14
12	0	0	3	1	1	3	0	1	0	1	1	0	12
Σ	3	4	12	9	7	5	3	5	3v	6	5	6	$\Sigma\Sigma$ 68
$\bar{X}$	.5	.67	2	1.5	1.17	.83	.5	.83	.5	1	.83	1	

TABLE III

LEARNING

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
13	3	1	3	3	3	3	3	2	2	1	2	2	28
14	1	3	4	4	4	1	0	0	1	2	0	2	24
15	4	2	3	4	4	1	2	2	2	3	3	2	33
16	4	4	4	3	2	4	2	2	2	3	4	3	37
17	3	2	1	2	4	3	2	4	2	2	2	2	29
18	1	2	1	2	4	3	2	4	2	2	2	2	27
Σ	16	14	16	18	21	16	11	14	11	13	15	13	$\Sigma\Sigma$ 178
$\bar{X}$	2.67	2.33	2.67	3	3.5	2.67	1.83	2.33	1.83	2.17	2.5	2.17	
SKILL II: BALL CATCHING													
13	2	3	3	2	3	3	2	4	2	3	3	2	31
14	3	0	3	4	0	0	0	0	1	2	2	2	17
15	1	0	2	2	2	2	1	2	0	0	1	1	14
16	2	2	2	3	0	1	2	3	3	3	3	2	26
17	0	1	1	2	2	1	3	2	2	2	1	1	18
18	1	3	3	1	0	0	2	1	1	2	3	2	19
Σ	9	9	14	14	7	7	10	12	9	12	13	10	$\Sigma\Sigma$ 126
$\bar{X}$	1.5	1.5	2.33	2.33	1.17	1.17	1.67	2	1.5	2	2.17	1.67	
SKILL III: BALL TOSSING													
13	1	1	2	2	2	1	2	0	2	2	1	1	17
14	1	2	2	2	0	0	1	0	1	0	1	1	11
15	0	0	4	2	2	3	0	3	1	0	0	0	15
16	4	1	2	3	2	0	1	1	1	1	2	3	21
17	4	3	4	2	1	2	1	1	0	0	1	1	20
18	0	1	3	1	1	0	1	1	0	0	1	2	11
Σ	10	8	17	12	8	6	6	6	5	3	6	8	$\Sigma\Sigma$ 95
$\bar{X}$	1.67	1.33	2.83	2	1.33	1	1	1	.84	.5	1	1.33	

TABLE IV

GROUP I, "SING-IT-AND-DO-IT" METHOD

RETENTION

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
1	2	2	2	2	2	2	2	2	2	2	2	1	23
2	0	1	0	1	1	0	2	0	0	0	1	0	6
3	1	0	0	1	1	0	0	0	0	0	0	0	3
4	1	0	1	1	1	0	0	0	0	1	0	0	5
5	1	1	2	1	0	1	1	0	0	0	0	0	7
Σ	5	4	5	6	5	3	5	2	2	3	3	1	$\Sigma\Sigma$ 44
$\bar{X}$	1	.8	5	1.2	1	.6	1	.4	.4	.6	.6	.2	
SKILL II: BALL CATCHING													
1	0	2	0	0	1	1	1	1	0	0	0	1	7
2	0	1	1	0	0	1	1	1	0	1	0	1	7
3	1	0	2	1	1	0	1	2	1	1	2	1	13
4	0	0	2	0	1	2	0	0	0	0	0	1	6
5	2	1	0	1	0	0	0	0	0	0	0	0	4
Σ	3	4	5	2	3	4	3	4	1	2	3	4	$\Sigma\Sigma$ 37
$\bar{X}$	.6	.8	1	.4	.6	.8	.6	.8	.2	.4	.6	.8	
SKILL III: BALL TOSSING													
1	0	1	0	0	0	1	1	1	0	0	0	1	5
2	0	1	0	0	0	0	0	0	0	0	0	1	3
3	0	0	0	1	1	0	0	1	0	0	0	1	4
4	1	2	1	0	0	1	0	0	0	0	1	0	6
5	2	2	0	0	0	0	0	0	1	0	1	0	6
Σ	3	6	2	1	1	2	1	2	1	0	2	3	$\Sigma\Sigma$ 24
$\bar{X}$	.6	1.2	.4	.2	.2	.4	.2	.4	.2	0	.4	.6	

TABLE V

GROUP II, "RHYTHM-ONLY" METHOD

RETENTION

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
7	3	2	2	2	2	2	2	2	3	2	2	2	26
8	2	2	2	2	2	2	2	2	2	2	2	2	24
9	2	2	2	1	2	2	2	2	2	1	1	0	18
10	2	2	2	1	2	2	1	0	0	0	2	0	14
Σ	9	8	8	6	8	8	7	6	7	5	6	4	$\Sigma\Sigma$ 82
$\bar{X}$	2.25	2	2	1.5	2	2	1.75	1.5	1.75	1.25	1.5	1	
SKILL II: BALL CATCHING													
7	1	1	0	1	2	1	0	1	1	0	1	0	9
8	3	2	1	2	3	2	0	1	1	0	0	0	15
9	0	1	1	2	1	0	2	1	1	2	1	0	12
10	2	1	0	1	1	0	0	0	1	2	0	1	9
Σ	6	5	2	6	7	3	2	3	4	4	2	1	$\Sigma\Sigma$ 45
$\bar{X}$	1.5	1.25	.5	1.5	1.75	.75	.5	.75	1	1	.5	.25	
SKILL III: BALL TOSSING													
7	1	0	1	0	1	0	1	1	0	1	0	1	7
8	3	2	1	1	1	1	0	1	1	0	0	0	11
9	1	0	1	2	2	1	2	0	1	0	1	0	11
10	1	1	1	1	2	1	1	1	1	1	1	1	13
Σ	6	3	4	4	6	3	4	3	3	2	2	2	$\Sigma\Sigma$ 42
$\bar{X}$	1.5	.75	1	1	1.5	.75	1	.75	.75	.5	.5	.5	

TABLE VI

GROUP III, LAISSEZ FAIRE METHOD

RETENTION

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
13	4	1	1	1	2	1	1	0	1	3	0	1	16
14	2	1	2	2	2	3	0	0	1	0	0	0	13
15	2	2	2	3	1	3	3	2	2	3	1	1	25
16	2	2	1	2	2	2	2	2	2	1	2	1	21
17	1	0	0	0	1	1	2	2	2	2	2	0	13
Σ	11	6	6	8	8	10	8	6	8	9	5	3	$\Sigma\Sigma$ 88
$\bar{X}$	2.2	1.2	1.2	1.6	1.6	2	1.6	1.2	1.6	1.8	1	.6	.
SKILL II: BALL CATCHING													
13	0	0	0	0	1	0	0	0	1	0	1	0	3
14	2	1	2	2	0	0	1	1	1	1	1	1	13
15	1	2	0	2	1	0	1	0	2	1	0	1	11
16	0	0	1	1	1	1	2	1	1	1	1	0	10
17	1	1	0	2	1	0	1	2	1	0	0	0	9
Σ	4	4	3	7	3	1	3	4	6	3	3	2	$\Sigma\Sigma$ 46
$\bar{X}$	.8	.8	.6	1.4	.6	.2	.6	.8	1.2	.6	.6	.4	.
SKILL III: BALL TOSSING													
1313	00	0	0	0	1	1	1	0	1	0	1	0	5
14	1	1	1	1	1	0	1	0	1	0	1	1	9
15	1	4	0	1	1	0	1	0	0	1	0	0	9
16	2	2	1	1	1	1	1	1	1	0	1	0	12
17	1	2	1	1	1	1	1	1	1	0	1	0	12
Σ	5	9	3	4	5	3	5	3	3	2	4	1	$\Sigma\Sigma$ 47
$\bar{X}$	1	1.8	.6	.8	1	.6	1	.6	.6	.4	.8	.2	.

TABLE VII

GROUP II, "RHYTHM-ONLY" GROUP, CHANGED TO "SING-IT-AND-DO-IT"

FIRST CHANGE IN METHOD

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
7	0	0	0	0	0	0	0	0	1	1	0	0	2
8	0	00	0	1	1	0	0	0	0	0	0	0	2
9	0	0	0	0	1	0	0	0	0	0	0	0	1-
10	0	0	1	0	1	1	1	2	1	0	0	0	7
Σ	0	0	1	1	3	1	1	2	2	1	0	0	$\Sigma\Sigma$ 15
$\bar{X}$	0	0	.25	.25	.75	.25	.25	.5	.5	.25	0	0	
SKILL II: BALL CATCHING													
7	0	0	0	0	0	1	0	1	1	1	0	1	5
8	0	1	0	0	0	0	0	0	0	1	0	0	2
9	0	0	1	1	1	0	0	0	1	1	0	1	6
10	0	1	1	1	0	0	0	1	1	1	0	1	7
Σ	0	2	2	2	1	1	0	2	3	4	0	3	$\Sigma\Sigma$ 20
$\bar{X}$	0	.5	.5	.5	.25	.25	0	.5	.75	1	0	.75	
SKILL II: BALL TOSSING													
7	0	1	0	0	0	0	0	0	0	1	1	1	4
8	0	0	0	0	0	0	0	0	0	0	1	0	1
9	1	0	0	1	0	0	0	1	1	1	0	0	5
10	1	0	1	0	0	0	1	1	1	0	0	1	6
Σ	2	1	1	1	0	0	1	2	2	2	2	2	$\Sigma\Sigma$ 16
$\bar{X}$	.5	.25	.25	.25	0	0	.25	.5	.5	.5	.5	.5	

TABLE VIII

GROUP III, LAISSEZ FAIRE GROUP, CHANGED TO "RHYTHM-ONLY" METHOD

FIRST CHANGE IN METHOD

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects:													
13	2	2	2	2	1	1	1	2	2	2	3	2	22
14	0	0	1	0	1	0	2	2	0	0	1	0	7
15	0	1	0	0	1	2	2	1	2	1	2	1	13
16	4	3	2	1	1	2	3	3	2	3	2	2	28
17	0	0	1	0	0	0	0	0	0	0	0	0	1
Σ	6	6	6	3	4	5	8	8	6	6	8	5	$\Sigma\Sigma$ 71
$\bar{X}$	1.2	1.2	1.2	.6	.8	1	1.6	1.6	1.2	1.2	1.6	1	
SKILL II: BALL CATCHING													
13	1	0	1	1	1	0	1	1	1	0	0	0	8
14	0	0	2	0	1	1	1	1	0	0	0	1	7
15	0	0	1	0	1	1	0	1	1	1	1	1	8
16	1	1	1	1	0	1	0	1	0	1	0	0	7
17	1	1	1	0	0	0	0	0	0	0	0	0	2
Σ	2	2	6	2	3	3	2	4	2	2	2	2	$\Sigma\Sigma$ 32
$\bar{X}$	.4	.4	1.2	.4	.6	.6	.4	.8	.4	.4	.4	.4	
SKILL III: BALL TOSSING													
13	1	1	1	0	1	1	1	1	1	1	0	1	10
14	0	1	0	1	1	1	1	1	1	0	0	1	8
15	1	1	1	1	1	0	1	1	1	1	1	1	11
16	1	1	2	1	1	0	1	1	0	0	1	0	9
17	0	0	0	0	0	0	0	0	0	0	0	0	0
Σ	3	4	4	3	4	2	4	4	3	2	2	3	$\Sigma\Sigma$ 38
$\bar{X}$	.6	.8	.8	.6	.8	.4	.8	.8	.6	.4	.4	.6	

TABLE IX

SECOND CHANGE IN METHOD

GROUP III, LAISSEZ FAIRE CHANGED FROM "RHYTHM-ONLY"

TO "SING-IT-AND-DO-IT" METHOD

SKILL I: ROPE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
13	1	1	1	1	0	0	0	0	1	1	0	0	6
14	0	1	0	0	0	0	0	0	0	0	0	0	1
15	0	1	0	0	1	1	0	0	0	1	0	0	4
16	0	1	1	1	1	0	1	1	0	2	1	1	9
17	0	0	0	0	0	0	0	0	0	0	0	0	0
Σ	1	4	2	2	2	1	1	1	1	4	1	1	$\Sigma\Sigma$ 21
$\bar{X}$	.2	.8	.4	.4	.4	.2	.2	.2	.2	.8	.2	.2	
SKILL II: BALL CATCHING													
13	1	1	0	0	0	0	0	0	0	0	0	0	2
14	0	1	0	0	0	0	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0	0	0	1	0	0	1
16	0	0	0	0	0	0	0	0	0	1	0	0	1
17	0	0	1	0	0	1	0	0	0	0	0	0	2
Σ	1	2	1	0	0	1	0	0	0	2	0	0	$\Sigma\Sigma$ 7
$\bar{X}$	.2	.4	.2	0	0	.2	0	0	0	.4	0	0	
SKILL III: BALL TOSSING													
13	1	0	0	0	0	1	0	1	0	0	0	0	3
14	0	0	0	1	0	1	0	0	0	0	0	0	2
15	0	0	0	0	0	0	0	0	1	0	0	0	1
16	0	0	0	1	0	0	0	0	0	1	0	1	3
17	0	1	0	0	0	0	0	0	0	0	0	0	1
Σ	1	1	0	2	0	2	0	1	1	1	0	1	$\Sigma\Sigma$ 10
$\bar{X}$	.2	.2	0	.4	0	.4	0	.2	.2	.2	0	.2	

TABLE IX

SECOND CHANGE IN METHOD

GROUP III, LABORS PAIRS CHANGED FROM "MATCH-ONLY" TO "RING-IT-ON-YOU-IT" METHOD

SKILL I: MOVE JUMPING

Trials	1	2	3	4	5	6	7	8	9	10	11	12	Total
Subjects													
13	1	1	1	0	0	0	0	0	1	0	0	0	4
14	0	1	0	0	0	0	0	0	0	0	0	0	1
15	0	1	0	0	1	1	0	0	0	1	0	0	4
16	0	1	1	1	1	0	1	1	0	0	1	0	7
17	0	0	0	0	0	0	0	0	0	0	0	0	0
Σ	1	3	2	1	2	1	1	2	1	1	1	0	16
$\bar{X}$	.2	.6	.4	.2	.4	.2	.2	.4	.2	.2	.2	0	.4

SKILL II: BALL CATCHING

13	1	1	0	0	0	0	0	0	0	0	0	0	2
14	0	1	0	0	0	0	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0	0	0	1	0	0	1
16	0	0	0	0	0	0	0	0	1	1	0	0	1
17	0	0	1	0	0	0	0	0	0	0	0	0	1
Σ	1	2	1	0	0	0	0	0	1	2	0	0	6
$\bar{X}$	.2	.4	.2	0	0	0	0	0	.2	.4	0	0	.1

SKILL III: BALL DRIBBLING

13	1	0	0	0	0	1	0	1	0	0	0	0	3
14	0	0	0	1	0	1	0	0	0	0	0	0	2
15	0	0	0	0	0	0	0	0	1	0	0	0	1
16	0	0	1	0	0	0	0	0	0	1	0	0	2
17	0	1	0	0	0	0	0	0	0	0	0	0	1
Σ	1	1	1	1	0	2	0	1	1	1	0	0	9
$\bar{X}$	.2	.2	0	.4	0	.4	0	.2	.2	.2	0	0	.6

TABLE X

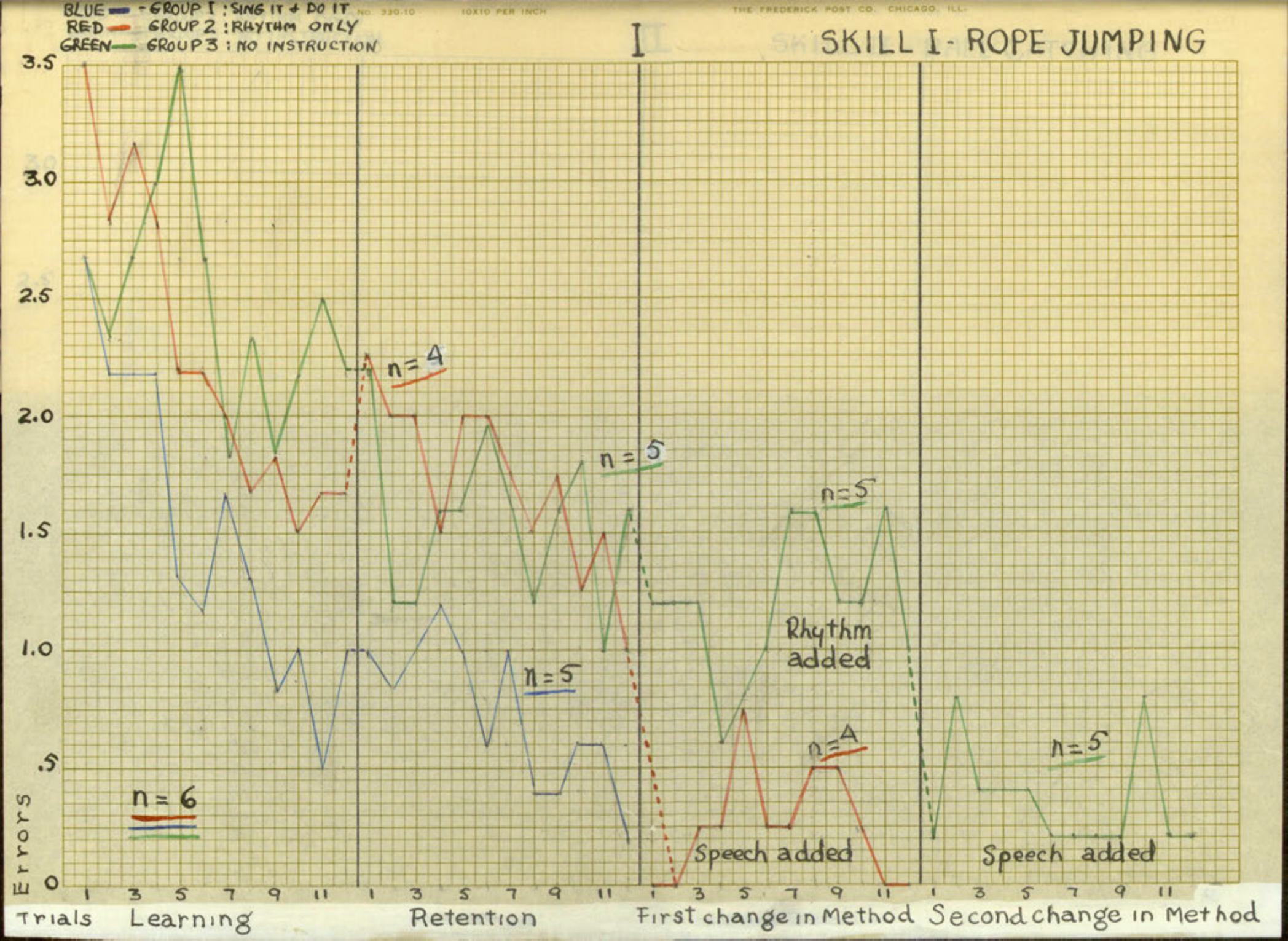
AGES OF BOYS AND GIRLS IN EACH GROUP

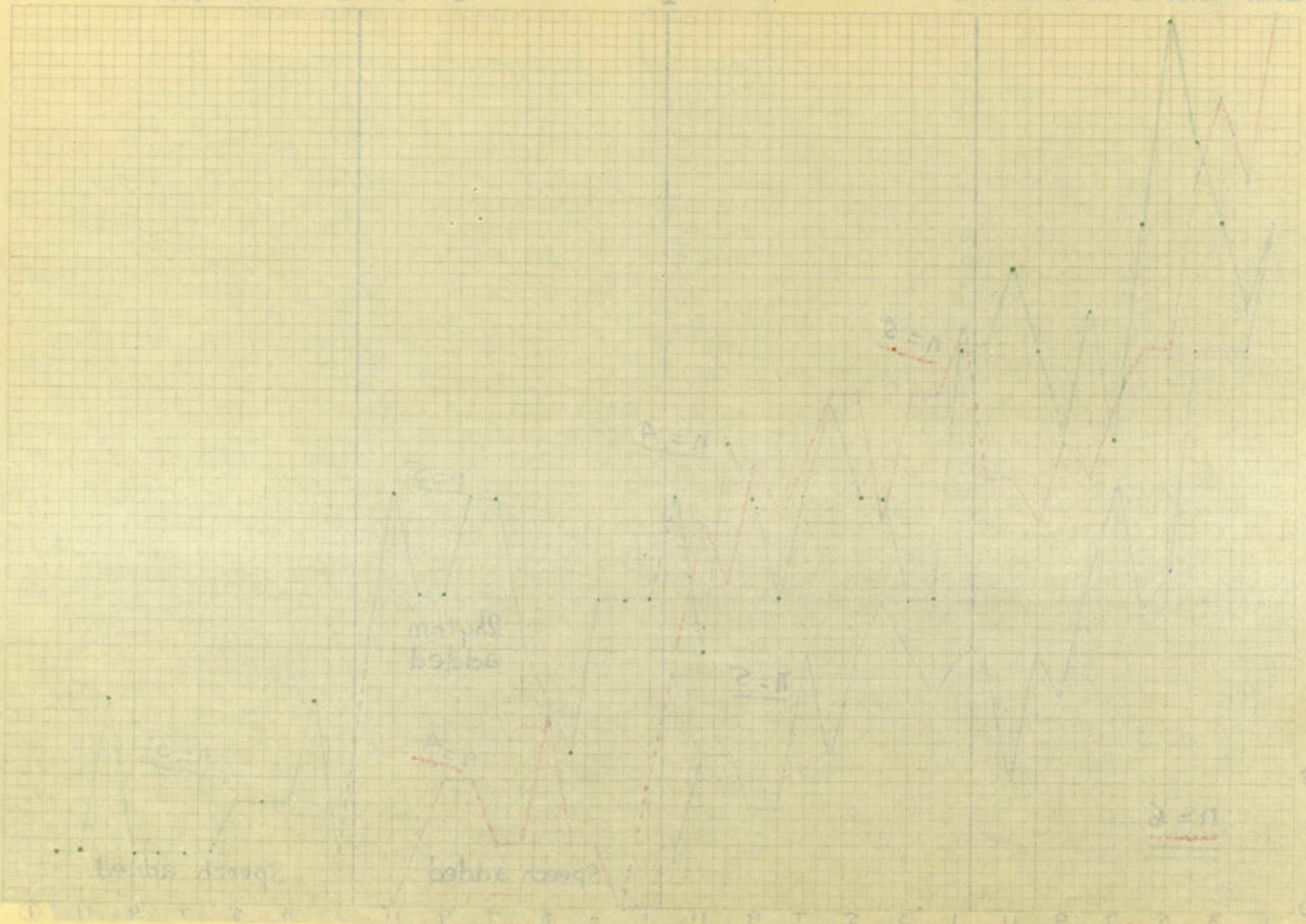
NO.		BIRTHDATE	AGE AT START OF TESTING Years		Months	
		GROUP I				
1	M	7-16-1944	4	Years	7	months
2	M	2-9-1944	5	"	1	"
3	F	9-23-1944	4	"	5	"
4	F	4-11-1944	4	"	11	"
5	F	7-23-1944	4	"	7	"
6	F	3-20-1944	5	"	0	"
		GROUP II				
7	M	12-23-1944	4	Years	3	months
8	M	6-19-1944	4	"	8	"
9	M	5-13-1944	4	"	10	"
10	F	8-29-1944	4	"	7	"
11	F	7-23-1944	4	"	6	"
12	F	2-8-1944	5	"	2	"
		GROUP III				
13	M	1-19-1945	4	Years	2	months
14	F	7-17-1944	4	"	7	"
15	F	9-13-1944	4	"	6	"
16	F	5-4-1944	4	"	10	"
17	F	3-3-1944	5	"	0	"
18	F	1-28-1945	4	"	1	"

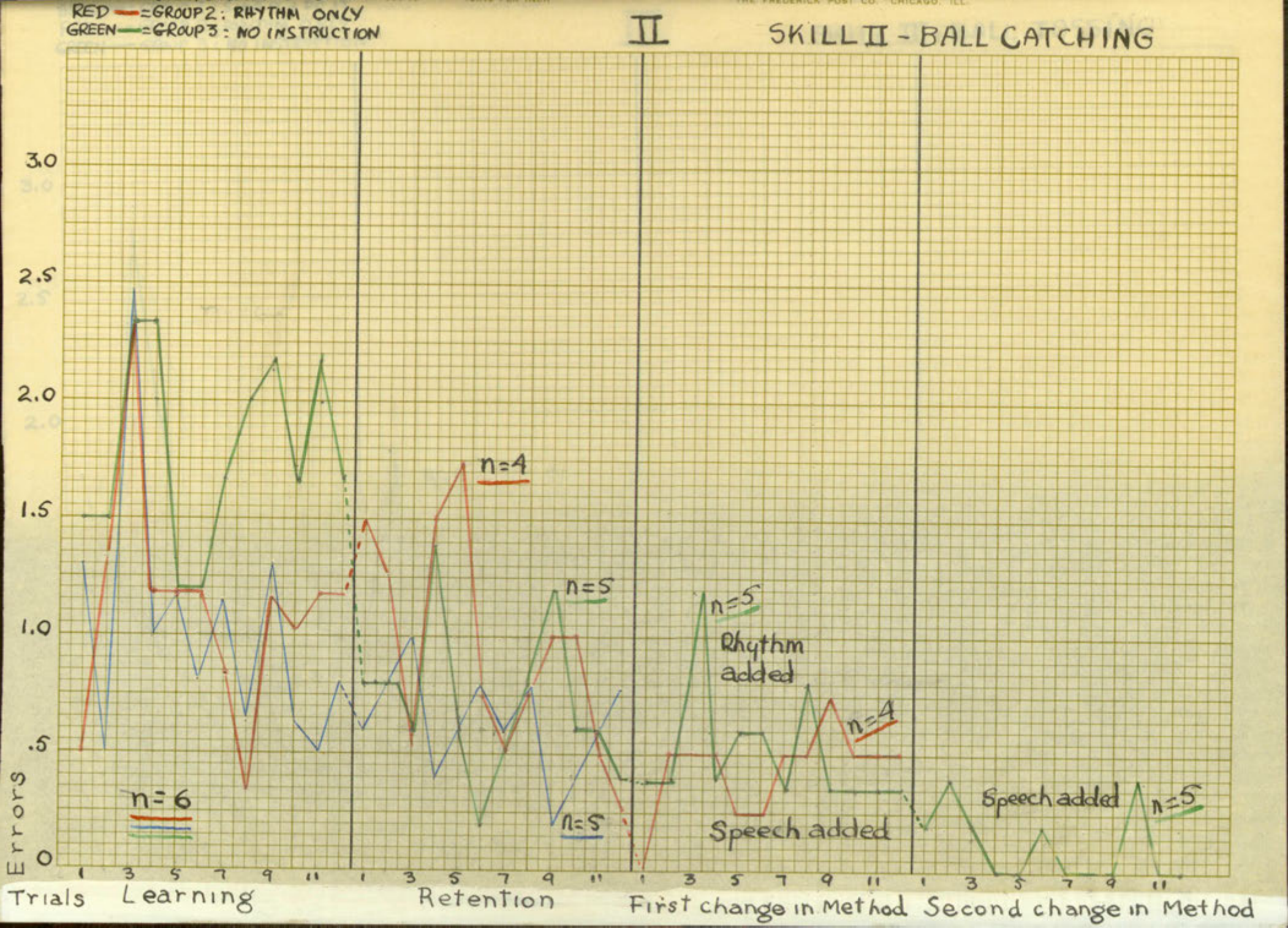
TABLE X

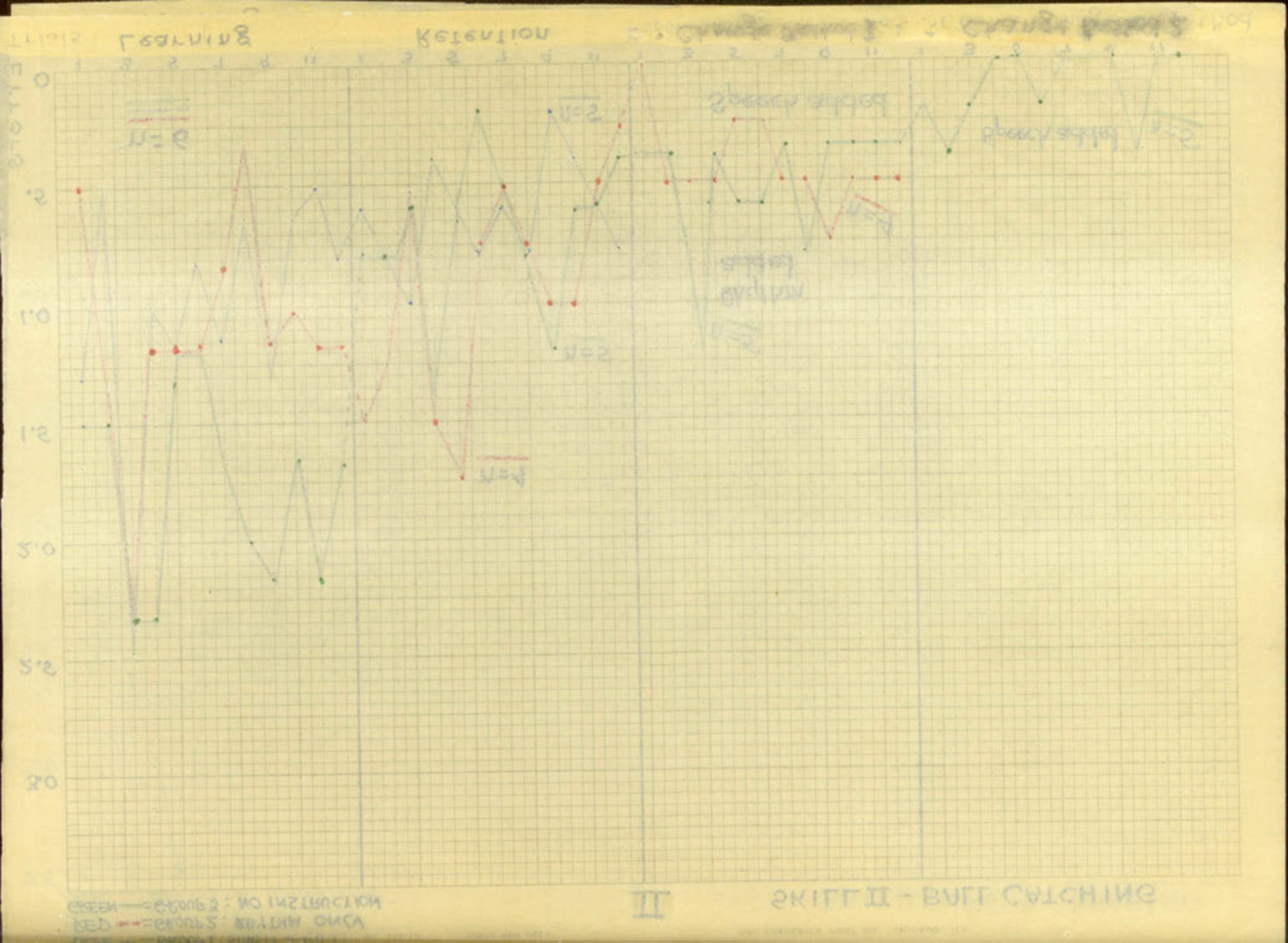
AGES OF BOYS AND GIRLS IN EACH GROUP

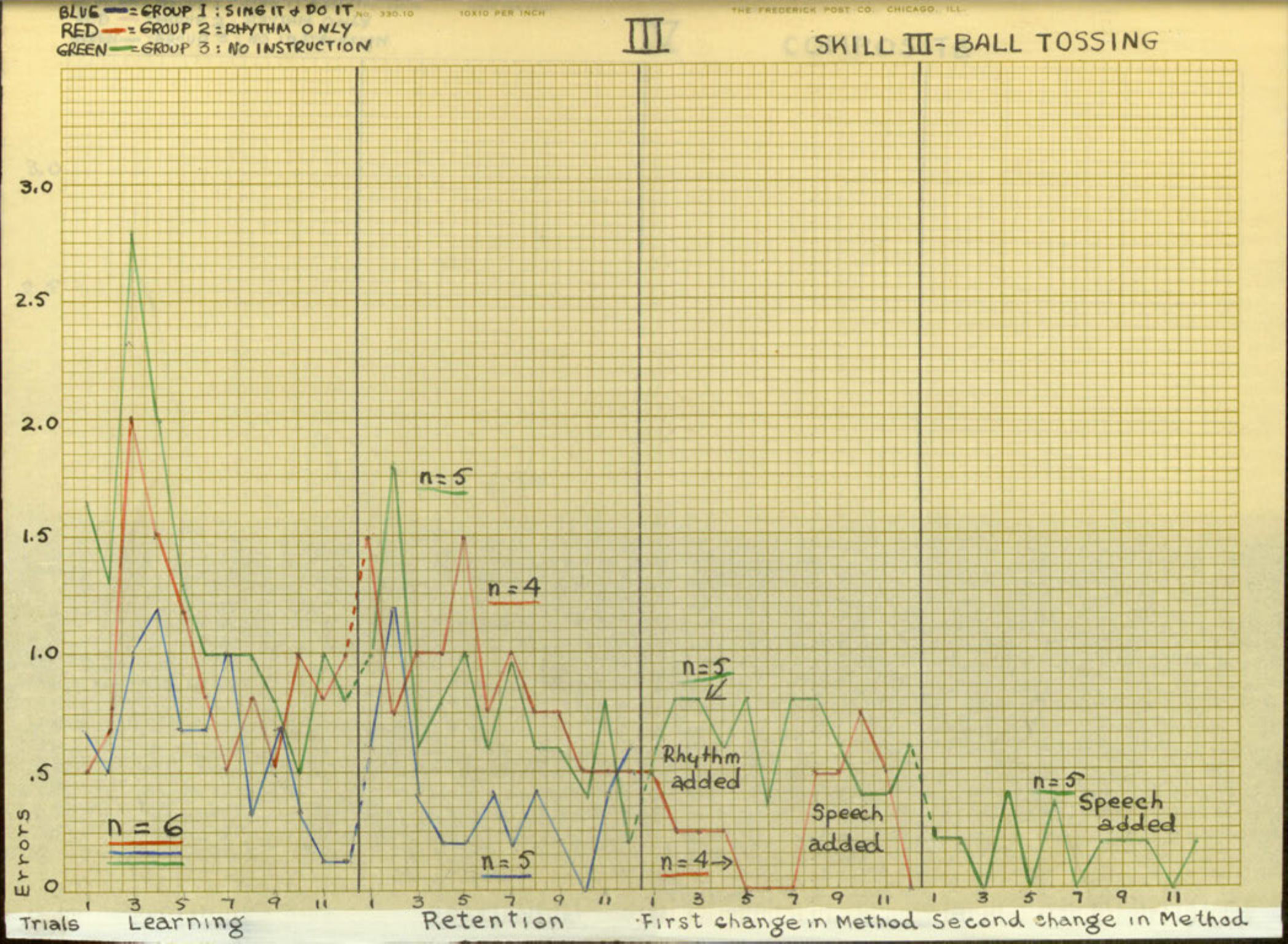
NO.		BIRTHDATE	AGE AT TIME OF TESTING Years	Months
		GROUP I		
1	M	7-16-1944	6	7
2	M	2-9-1944	5	8
3	F	9-29-1944	4	6
4	F	4-11-1944	5	3
5	F	7-27-1944	4	7
6	F	3-26-1944	5	2
		GROUP II		
7	M	12-27-1944	4	3
8	M	6-19-1944	4	8
9	M	5-17-1944	5	4
10	F	8-22-1944	4	7
11	F	7-23-1944	4	8
12	F	2-8-1944	5	8
		GROUP III		
13	M	1-19-1944	5	5
14	F	7-17-1944	4	8
15	F	9-13-1944	4	6
16	F	5-4-1944	5	10
17	F	3-3-1944	5	9
18	F	1-23-1944	5	2

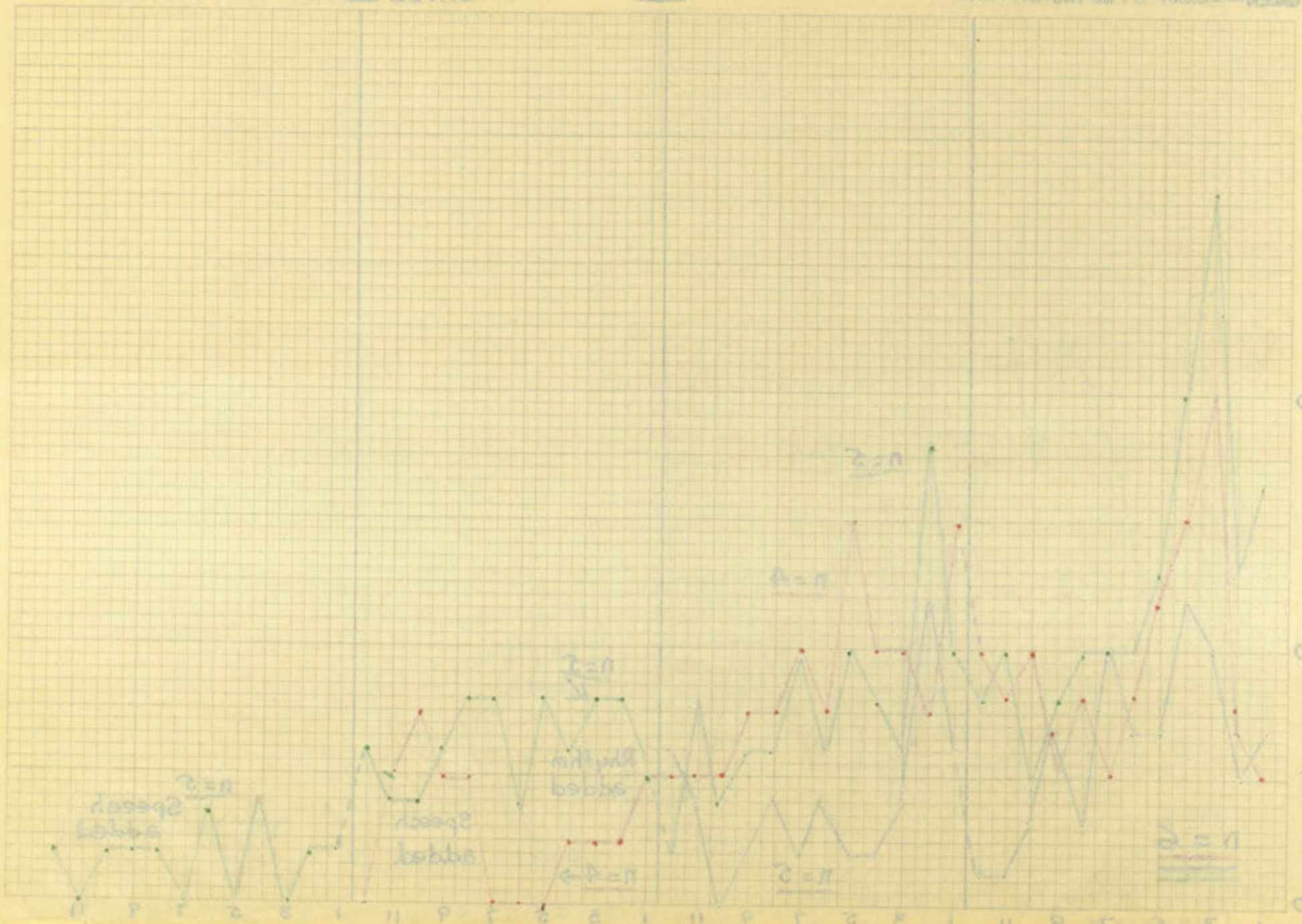

BLUE - GROUP I : SING IT & DO IT
RED - GROUP 2 : RHYTHM ONLY
GREEN - GROUP 3 : NO INSTRUCTION
I
SKILL I - ROPE JUMPING
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
Errors
n = 6
n = 4
n = 5
n = 5
n = 5
n = 4
n = 5
Rhythm added
Speech added
Speech added
1 3 5 7 9 11
1 3 5 7 9 11
1 3 5 7 9 11
1 3 5 7 9 11
Trials
Learning
Retention
First change in Method
Second change in Method

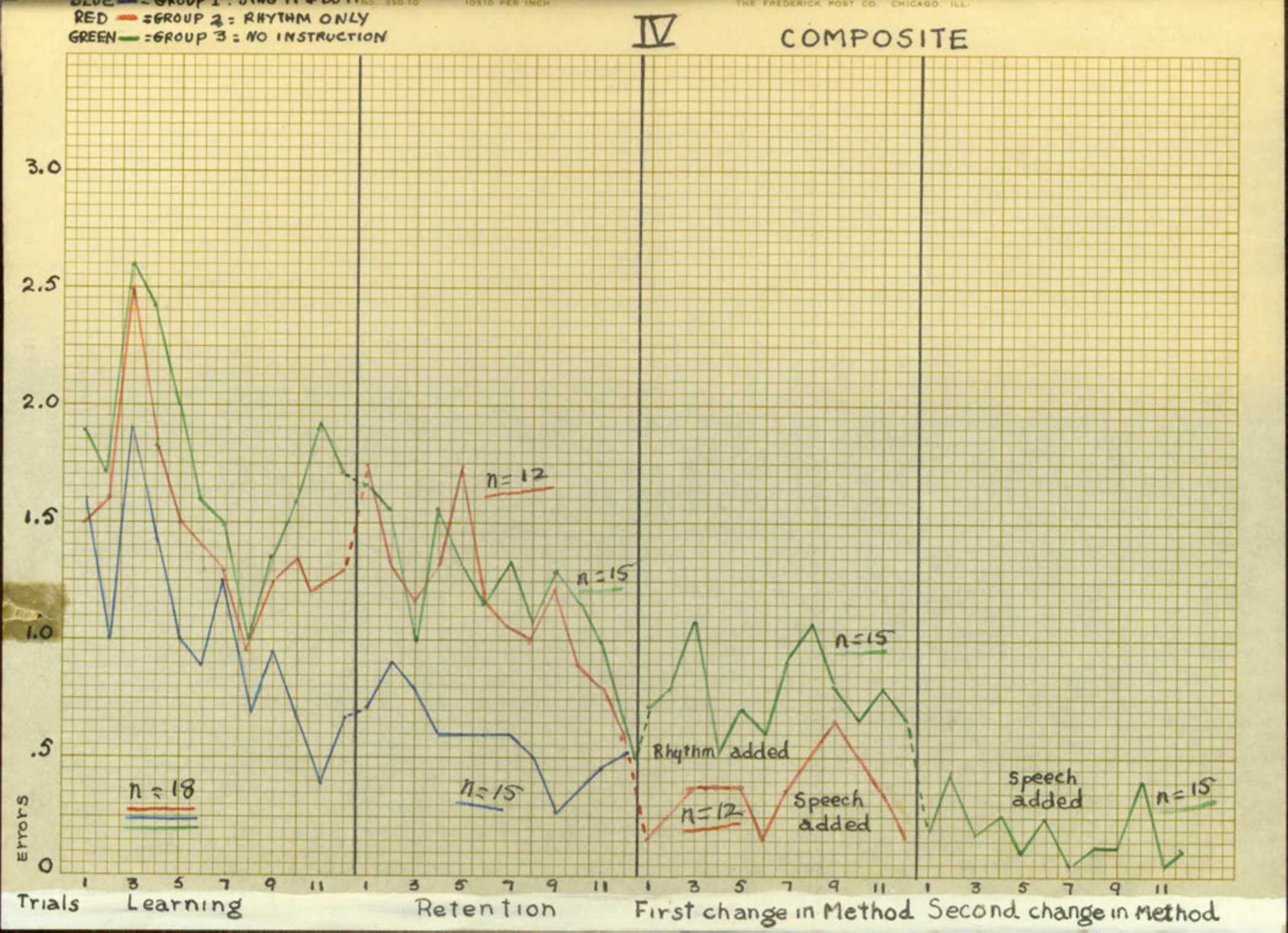


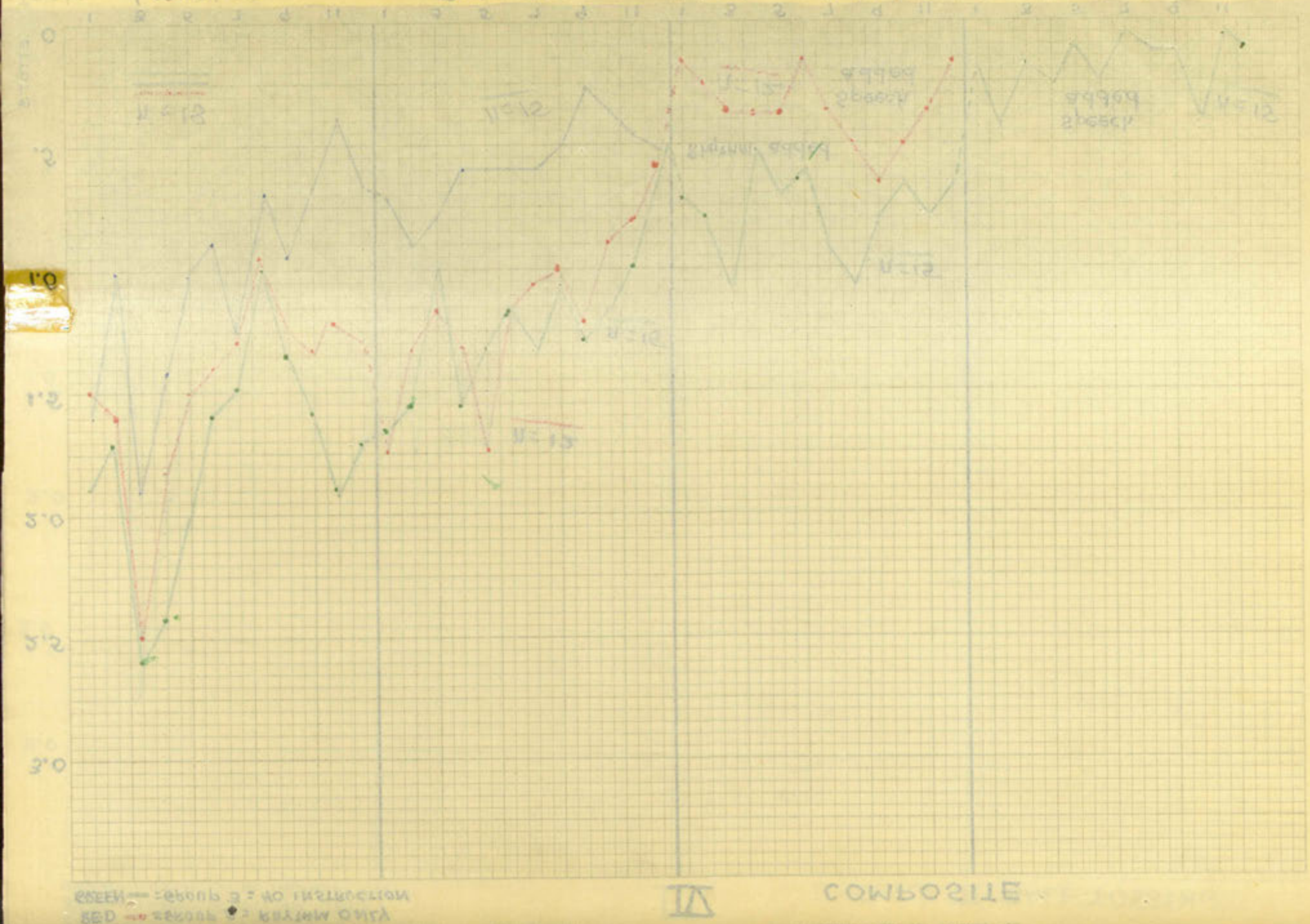

RED —=GROUP 2: RHYTHM ONLY
GREEN —=GROUP 3: NO INSTRUCTION
II
SKILL II - BALL CATCHING
3.0
2.5
2.0
1.5
1.0
.5
0
Errors
n=6
n=4
n=5
n=5
n=5
Rhythm added
n=4
Speech added
Speech added
n=5
1 3 5 7 9 11
1 3 5 7 9 11
1 3 5 7 9 11
1 3 5 7 9 11
Trials
Learning
Retention
First change in Method
Second change in Method


LEARNING
RETENTION
SKILL II - BALL CATCHING
II
GREEN —=GROUP 2 : NO INSTRUCTION
RED - -=GROUP 1 : WITHIN ONCE
SCORE
2.0
2.5
1.0
1.5
3.0
3.5
N=8
N=2
N=4
N=2


BLUE = GROUP 1 : SING IT & DO IT
RED = GROUP 2 : RHYTHM ONLY
GREEN = GROUP 3 : NO INSTRUCTION
III
SKILL III - BALL TOSSING
3.0
2.5
2.0
1.5
1.0
.5
0
Errors
n = 6
n = 5
n = 4
n = 5
Rhythm added
n = 4
Speech added
n = 5
Speech added
1 3 5 7 9 11
Trials
Learning
Retention
First change in Method
Second change in Method


n=5
n=4
n=5
Speech added
Rhythm added
Speech added
n=4
n=5
n=6
3.0
2.5
2.0
1.5
1.0
.5
0
Learning
Retention
Change Method 1
Change Method 2


BLUE = GROUP 1 : JING IN & OUT
RED = GROUP 2 : RHYTHM ONLY
GREEN = GROUP 3 : NO INSTRUCTION
IV
COMPOSITE
3.0
2.5
2.0
1.5
1.0
.5
0
Errors
n = 18
n = 12
n = 15
n = 15
n = 12
n = 15
n = 15
Rhythm added
Speech added
Speech added
1 3 5 7 9 11
Trials
Learning
Retention
First change in Method
Second change in Method


COMPOSITE
IV
GREEN = 1 SECOND, B = NO INSTRUCTION
RED = 2 SECONDS, A = MAXIMUM DATA

D.T.

IMPORTANT!

Special care should be taken to prevent loss or damage of this volume. If lost or damaged, it must be paid for at the current rate of typing.