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**A CORRELATION STUDY OF PERSONALITY FACTORS
AND LEARNING SELECTED MOTOR SKILLS IN
TRADITIONAL AND PROGRAMMED
INSTRUCTION METHODS**

Sylvia Sue Hargrove McDonald

**A dissertation presented to the
Graduate Faculty of Middle Tennessee State University
in partial fulfillment of the requirements
for the degree Doctor of Arts**

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AND LEARNING SELECTED MOTOR SKILLS IN
TRADITIONAL AND PROGRAMMED
INSTRUCTION METHODS

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ABSTRACT

A CORRELATION STUDY OF PERSONALITY FACTORS AND LEARNING SELECTED MOTOR SKILLS IN TRADITIONAL AND PROGRAMMED INSTRUCTION METHODS

by Sylvia Sue Hargrove McDonald

The purpose of this study was to find a relationship between selected personality factors and tennis skill growth in a programmed and traditional learning environment. The tennis skills include the forehand drive, backhand drive, and service.

The subjects were sixty-three male and female students enrolled in four beginning tennis classes during the 1974 fall term at Calhoun Community College. A random process was used to assign classes to the programmed and traditional methodology. The investigation period consisted of four and one-half weeks whereby the subjects met twice weekly for nine 50-minute class periods.

Skill growth was determined by pre- and post-tests using the Broer-Miller Forehand-Backhand Drive Test and Hewitt Tennis Achievement Test--Speed of Service. Cattell's

Sixteen Personality Factor Questionnaire (16PF) was administered to all subjects.

Data treatment was as follows: (1) a coefficient of correlation was used to relate personality factors and tennis skill growth in each methodology and (2) a multiple regression correlation coefficient calculated the personality factors as a group to predict tennis skill growth in each methodology.

Using a .05 level of significance, the major findings are as follow: (1) a significant correlation exists in the traditional methodology between service skill growth and the personality factors F- (sober), M+ (imagination), and I- (tough-minded); (2) there is a significant correlation in the traditional methodology between service skill growth and all sixteen personality factors as a group; and (3) no significance exists in the programmed methodology between tennis skill growth and personality factors.

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Chapter 1

INTRODUCTION

During the past decade many innovations in motor skill learning were sought and implemented in the discipline of physical education. This onrush to seek the best means for education of a mass society has resulted in the implementation of various teaching methodologies. As attention has been directed toward a wide spectrum of methods,¹ little or no emphasis has been placed on the process by which students are placed in specific learning situations so that optimum individual motor skill learning can take place. Instead, in many instances, mass adaptation of a specific instructional method has taken place within

¹June Cochrane, "Student Centered Physical Education," Journal of Health, Physical Education and Recreation, XLIV (September, 1973), 25; also, see Max Cogan, "Innovative Ideas in College Physical Education," Journal of Health, Physical Education and Recreation, XLIV (February, 1973), 28-29; Wallace M. Pina, "The Systems Approach in Physical Education," Journal of Health, Physical Education and Recreation, XLII (November-December, 1971), 57-58; Natlie Willman Duffy, "Interdisciplinary Independent Study," Journal of Health, Physical Education and Recreation, XLIV (September, 1973), 73; John Gustafson, "Making Programed Instruction Practical," Physical Educator, XXX (May, 1973), 91; Bryan C. Smith and Harold A. Lerch, "Contract Grading," Physical Educator, XXX (May, 1973), 91.

colleges and public schools without concern for realizing the many existing individual student personality differences.²

Although the general nature of these innovative methods has been declared to better suit student needs, many of them only replace an older method without consideration for personality differences. Learners are grouped, too often, in a class situation without minimal concern for the affective areas of behavior.³ The result has been that students representing varying personalities have been subjected to a single instructional method. In general, physical educators have failed to be concerned with the aspect of personality as occupying a significant key in developing psychomotor skills. A reason for the disinterest in the personality-methodology relationship has been a lack of evidence to indicate the need for different methods according to specific personalities. Therefore, it behooves all physical educators to consider personality aspects as occupying a vital area in terms of motor skill learning.

"Personality is usually identified as a way of behavior peculiar to the individual and as such, each person

²Gail Brown, personal interview, August 15, 1974.

³William R. Osmon, "The Personality Patterns of Failing Freshmen," Teachers College Journal, XXV (November 1963), 61.

may be expected to react in a fairly consistent but unique manner in a particular situation."⁴ Some physical educators, such as Rushall,⁵ indicate that identification of certain personality traits can provide an indication as to the type learning situation needed for skill growth. Rushall suggests that knowledge of personality factors can bring individuality into the instructional program which will help develop each individual player's potential for performance. Thus, the possibility exists that motor skill growth and learning may be partially related to that unique combination of personality traits and instructional methodology.

STATEMENT OF THE PROBLEM

The purpose of this study was to determine the correlation between selected personality factors and tennis skill growth in a programmed and traditional learning environment. Specifically, the tennis skills include the forehand drive, backhand drive and service, while the

⁴Robert N. Singer, The Psychomotor Domain: Movement Behaviors (Philadelphia: Lea & Febiger, 1972), p. 6.

⁵Brent Rushall, "Some Practical Applications of Personality Information to Athletics," Contemporary Psychology of Sport, ed. G. S. Kenyon (Washington, D.C.: International Society of Sport Psychology, 1968), pp. 167-168.

personality factors are those specified in Cattell's Sixteen Personality Questionnaire.⁶

SIGNIFICANCE OF THE STUDY

There is some research indicating that the cognitive domain and the ability to learn are related to personality aspects. Specifically, psychological research of the cognitive nature has linked certain relationships between personality factors and cognitive learning. In 1966, Sealy and Cattell⁷ found that rates of cognitive learning were related to personality factors at the child level. Also, a review of the "Information Exchange Memorandum," published by the Institute for Personality and Ability Testing (UPAT from 1965 to 1968),⁸ indicates some research had been conducted relating personality factors and academic achievement.

Although there is some evidence to sustain certain cognitive domain and personality trait relationships, there

⁶Raymond Cattell, Herbert Eber, and Maurice Tatsouka, Handbook for the Sixteen Personality Questionnaire 16PF (Champaign, Illinois: Institute for Personality and Ability Testing, 1970), pp. 80-111.

⁷Cattell, Eber, and Tatsouka, p. 237.

⁸Information Exchange Memorandum, No. 3, 1965, Information Exchange Memorandum, No. 4, 1968, Institute for Personality and Ability Testing (Champaign, Illinois: The Institute for Personality and Ability Testing, 1965, 1968).

is even less evidence to establish a psychomotor domain-personality relationship in the area of physical education. Psychological investigations provide the only available data relating personality aspects to psychomotor task learning. This information regards such learning tasks as target tracking,⁹ maze testing,¹⁰ and pursuit rotor apparatus.¹¹ Evidence to support the psychological studies includes such theories as Eysenck's¹² theory which states that certain personalities choose speed over accuracy, while other personality traits prefer accuracy over speed. As early as 1946, Himmelweit¹³ found that performance on a manual tracking task provides support for Eysenck's theory. He found that introverts were slower and more careful, thus making fewer mistakes, while extroverts were faster but had a greater number of mistakes.

⁹I. Maltzman, W. M. Smith, and W. O. Brooks, "Some Effects of Different Training Conditions and Manifest Anxiety Upon Target Tracking," Psychological Abstracts (August, 1956), 502, C. M. Louttit, ed., XXX, Abstract No. 5642.

¹⁰G. A. Foulds, "Temperamental Differences in Maze Performance," British Journal of Psychology, XLIII (February, 1952), 33-34.

¹¹A. W. Bendig and Charles R. Eigenbrode, "A Factor Analytic Investigation of Personality Variables and Reminiscence in Motor Learning," Journal of Abnormal and Social Psychology, LXII (May, 1961), 698-700.

¹²H. J. Eysenck, The Biological Basis of Personality (New York: C. C. Thomas, 1967), p. 160.

¹³H. T. Himmelweit, "Speed and Accuracy of Work as Related to Temperament," British Journal of Psychology, XXXVI (September, 1946), 132-144.

Although there have been developments from within the psychological field to suggest certain personality-psychomotor task learning relationships, it seems remarkable that physical educators have not actively pursued this endeavor. According to evidence in existing literature, physical educators have made very vague attempts to investigate this area. The present-day emphasis on attaining workable methodological techniques would certainly lend itself to achieving learning environments based on specific personality trait needs.

Indeed, some physical educators indicate the possibility of a motor skill learning-personality relationship, although none have attempted the task of identifying such. Sources such as Oxendine¹⁴ state that "the personality of the participant seems to have varying effects on learning and performance." Oxendine offers no conclusive evidence, but he does indicate there is little dispute about the influence of personality on the individual's level of skill and type of task.

Predictive indices for motor skill learning based on personality factors would allow students to be placed in specific instructional environments. The lack of evidence pertaining to the personality-motor skill learning relationship in physical education methodology provides the

¹⁴Joseph B. Oxendine, Psychology of Motor Learning (New York: Appleton-Century-Crofts, 1968), p. 187.

basis for this study. Therefore, it was hoped that this investigation might shed light on the existence of various personality traits that would affect motor skill learning in both a programmed and traditional learning environment.

LIMITATIONS OF THE STUDY

The following limitations were noted in this study.

1. All of the subjects were freshman and sophomore men and women students enrolled in beginning tennis classes at Calhoun Community College during the 1974 fall term. Thirty-seven subjects were in the experiment group and twenty-six subjects were in the control group. Their ages fell within the age category of eighteen through twenty-two years of age. The subjects had not received prior high school, college or professional tennis instruction, nor had they played tennis more than fifteen times during the past two years. Subjects were not selected according to interest, intelligence or personality traits.

2. This study dealt with a group of subjects who specifically followed a programmed instructional method and a group of subjects who specifically followed a traditional instructional method. Instruction of all subjects was under the direction of the writer.

3. The instructor requested that all subjects engage in tennis practice only during the designated class

instruction time. The instructor witnessed three subjects playing tennis after school and eliminated these people from the study. The subjects eliminated were in the traditional group which reduced the original number of twenty-nine subjects to twenty-six.

4. The investigation covered nine 50-minute consecutive instruction periods meeting two times per week, excluding rainy days. Three regular class days were missed due to inclement weather; therefore, the study was lengthened to six weeks instead of the originally planned four and one-half weeks. All subjects completed nine 50-minute instruction periods.

DEFINITIONS OF TERMS

Programmed Instruction

Programmed instruction is a form of pedagogy based on stimulus, response and reinforcement theory in which self-teaching materials are presented in a series of small steps which lead a student from what he knows to what is new and more complex.¹⁵ For purposes of this study, the tennis

¹⁵Edward Meyers, "A Comparison of Four Methods of Feedback in Programmed Instruction for Teaching Shooting in Archery" (unpublished doctoral dissertation, Springfield College, 1972).

programmed instruction is that described in Tennis Individualized Instruction Program.¹⁶

Traditional Instruction

This is described as periods of verbal instruction in which the student receives essential information and demonstration regarding skills and periods of activity in which the student creates for himself a movement pattern which meets his preconceived needs and goals as well as conforming to teacher objectives.¹⁷

Motor Skill

A motor skill is the ability of a person to integrate body movements into a pattern for some specific purposes.¹⁸ For purposes of this study, the specific motor skills are the tennis forehand, backhand and service.

Skill Growth

This term refers to a measurement of skill achievement by obtaining the difference between the post-test and pre-test scores.

¹⁶Anthony Annarino, Tennis Individualized Instruction Program (Englewood Cliffs: Prentice-Hall, Inc., 1973), pp. 12-37.

¹⁷Robert N. Singer, Motor Learning and Human Performance (Toronto: The Macmillan Company, 1969), p. 15.

¹⁸John D. Lawther, "Directing Motor Skill Learning," Quest, IV (May, 1968), 68.

Learning

The organization of behavior according to the performance demands of some skill¹⁹ is referred to as learning.

Personality

Personality is based upon the assumption that there are consistencies in behavior which are evidenced in a variety of situations.²⁰ For purposes of this study, the behavior consistencies are the sixteen personality factors described in Cattell's Sixteen Personality Questionnaire (16PF). Each personality factor represents a dimensional continuum of behavior. The continua of these factors are described as follow.²¹

Factor A--reserved versus outgoing

Factor B--less intelligent versus more intelligent

Factor C--affected by feelings versus emotionally stable

Factor E--humble versus assertive

Factor F--sober versus happy-go-lucky

Factor G--expedient versus conscientious

¹⁹Bryan J. Cratty, Psychology and Physical Activity (Englewood Cliffs: Prentice-Hall, Inc., 1968), p. 15.

²⁰Cratty, p. 15.

²¹Cattell, Eber, and Tatsouka, pp. 80-111.

Factor H--shy versus venturesome

Factor I--tough-minded versus tender-minded

Factor L--trusting versus suspicious

Factor M--practical versus imaginative

Factor N--forthright versus shrewd

Factor O--placid versus apprehensive

Factor Q₁--conservative versus experimenting

Factor Q₂--group-dependent versus self-sufficient

Factor Q₃--casual versus controlled

Factor Q₄--relaxed versus tensed

HYPOTHESES

The purpose of this investigation was to test the following null hypotheses:

HO₁: There will be no significant correlation between the selected personality Factor A and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₂: There will be no significant correlation between the selected personality Factor B and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₃: There will be no significant correlation between the selected personality Factor C and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₄: There will be no significant correlation between the selected personality Factor E and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₅: There will be no significant correlation between the selected personality Factor F and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₆: There will be no significant correlation between the selected personality Factor G and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₇: There will be no significant correlation between the selected personality Factor H and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₈: There will be no significant correlation between the selected personality Factor I and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₉: There will be no significant correlation between the selected personality Factor L and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₀: There will be no significant correlation between the selected personality Factor M and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₁: There will be no significant correlation between the selected personality Factor N and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₂: There will be no significant correlation between the selected personality Factor O and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₃: There will be no significant correlation between the selected personality Factor Q₁ and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₄: There will be no significant correlation between the selected personality Factor Q₂ and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₅: There will be no significant correlation between the selected personality Factor Q₃ and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₆: There will be no significant correlation between the selected personality Factor Q₄ and tennis skill growth in: A. a programmed learning environment--(1) forehand-backhand drive, (2) service; and B. a traditional learning environment--(1) forehand-backhand drive, (2) service.

HO₁₇: There will be no significant correlation between the entire group of selected personality factors and tennis skill growth in: A. the backhand-forehand drive in a programmed setting; B. the service in a programmed setting; C. the forehand-backhand drive in a traditional setting; and D. the service in a traditional setting.

Chapter 2

REVIEW OF THE LITERATURE

The review of literature concentrated on related studies in four areas: (1) instructional methods in tennis, (2) personality factors and cognitive learning, (3) personality factors and psychomotor learning, and (4) personality traits of athletes.

INSTRUCTIONAL METHODS IN TENNIS

Although programmed instruction is regarded to be a recent development, Skinner¹ indicates that Socrates was a programmer in his own right as evidenced by his step-by-step deductive reasoning which led a student to new knowledge. The first studies in programmed instruction, according to Pressey,² involved the cognitive domain, while very recently investigations have been conducted in the psychomotor

¹B. F. Skinner and James F. Hollan, The Analysis of Behavior (New York: McGraw-Hill, 1961), p. 2.

²S. L. Pressey, "A Third and Fourth Contribution Toward the Coming 'Industrial Revolution' in Education," Teaching Machines and Programmed Learning, eds. A. A. Lunsdaine and Robert Glaser (Washington, D.C.: National Educational Association, 1960), pp. 47-51.

domain. In the area of physical education, few studies have been conducted concerning programmed instruction or in a comparison of programmed with traditional instruction.

There are advantages and disadvantages in the use of any instructional method. Milton C. Newman and Robert N. Singer³ have listed the advantages of both the traditional and programmed methods of learning. Some of the advantages of the traditional method include:

. . . (1) permits more creativity in learning because the learner is not necessarily bound to a predetermined learning pattern; (2) allows the student to more readily explore his errors; (3) allows the social environment to interact with the learning environment.

The advantages of the programmed learning method include:

. . . (1) provides for student's individual rate of learning; (2) causes constant participation of the students in the learning process because a response must be made in order to proceed; and (4) corrects errors before they persist.

Joan Farrell⁴ conducted an investigation of programmed and traditional teacher-directed instruction in 1967 at the University of Michigan. Ninety freshmen women enrolled in beginning tennis classes were administered pre- and post-tests using the Broer-Miller Forehand-Backhand

³Milton C. Newman and Robert N. Singer, "A Comparison of Traditional Versus Programmed Methods of Learning Tennis," Research Quarterly, XLII (December, 1971), 1045.

⁴Joan E. Farrell, "Programmed Instruction in Beginning Tennis," Research Quarterly, XLI (March, 1970), 1045.

Drive Test and the Wallboard Test. The investigation results were limited to development of the tennis forehand and backhand drives over seven 50-minute practice periods. Farrell found that the highly skilled student did not improve in the forehand and backhand drive in the traditional classes but did make significant gains in the programmed method of instruction. The more poorly skilled students made significant gains in both instructional methods.

In a study involving forty students enrolled in beginning tennis classes at Illinois State University, Milton C. Newman⁵ used the Hewitt Revised Dyer Backboard Tennis Test to determine general tennis skills in traditional and programmed instructional classes. Both groups met twice a week for a seven-week period, with each session consisting of a 60-minute period. The findings indicated the traditional and programmed instructional methods differed little in their effect on general tennis skill achievement.

The performance of undergraduates in beginning tennis classes was investigated by Donat⁶ at the University

⁵Newman and Singer, p. 1045.

⁶Robert Fuertges Donat, "The Effect of Programmed Instruction on Selected Tennis Skills, Knowledge and Attitude" (unpublished Doctoral dissertation, University of Utah, 1970).

of Utah in 1970. The subjects were divided into groups taught by programmed and conventional instructional methods. Hewitt's Revised Dyer Blackboard Tennis Test was employed as the test criteria. Donat found no significant improvement in either of the two instructional approaches.

An interesting experiment by Mariani⁷ investigated the effectiveness of the task and command methods of teaching tennis to sixty male students at Florida Atlantic University in 1970. The task method provided the student with the opportunity to make many more decisions than he would normally make in the conventional method. The Boer-Miller Forehand-Backhand Drive Test was administered to the subjects in a pre- and post-test. Results revealed the task method was superior to the command method in the backhand drive.

No significant difference was found between two tennis teaching methods in a study by Cragin⁸ in 1965. Thirty-eight women in beginning tennis classes were assigned to groups taught by the traditional and a special drill

⁷Tom Mariani, "A Comparison of the Effectiveness of the Command Method and the Task Method of Teaching the Forehand and Backhand Tennis Strokes," Research Quarterly, XXXI (May, 1970), 171-174.

⁸Walter F. Cragin, "A Comparison of Two Methods of Teaching Beginning Tennis" (unpublished Master's thesis, Louisiana State University, 1965).

method designed to provide more intensive practice on basic skills. The Broer-Miller Forehand-Backhand Test was administered at the twelfth, twenty-fourth, and thirty-sixth class meetings as the test criteria.

Schrodeder⁹ studied two groups of fourteen college women equated on the basis of scores on the Scott-Motor Ability Test and past tennis experience. The groups were instructed in a massed condition and distributed practice condition. Each group received four weeks of instruction in the forehand drive and were administered the Broer-Miller Forehand Drive Test. Then the backhand drive was taught for four weeks using reversed practice conditions with the Broer-Miller Backhand Drive Test being administered at the end of the four-week period. A significant difference in performance was revealed in the backhand in favor of the distributed practice group.

In 1968, Van Oreghen¹⁰ found no measurable difference in tennis achievement between an experimental softball and traditional teaching approach. College women

⁹Pamela Schrodeder, "Massed Versus Distributed Practice on the Learning of the Forehand and Backhand Tennis Drive" (unpublished Master's thesis, University of North Carolina at Greensboro, 1968).

¹⁰Sharon Van Oreghen, "A Comparison of Two Methods of Teaching Tennis to College Women" (unpublished Master's thesis, Indiana University, 1968).

in two beginning tennis classes were evaluated using the Hewitt Revision of the Dyer Backboard Test.

One class of tenth-grade girls was taught the tennis forehand drive followed by the backhand drive, whereas another class was instructed in the opposite sequence in a study by Sprague.¹¹ The two groups were administered pre- and post-tests using the Broer-Miller Forehand-Backhand Drive Test and the Dyer Backboard Test. The backhand first group performed significantly better than the forehand first group on the post-Broer-Miller Drive Test, while the post-Dyer Backboard Test favored the performance of the forehand first group.

Individualized tennis programmed instruction packets, designed by Anthony Annarino,¹² are currently being utilized in tennis classes at Purdue University. Annarino reports that, although research is still in infancy, available results indicate that the individualized programmed method has great merit.

¹¹Harriet Sprague, "A Comparison of Two Different Sequences in Teaching the Ground Strokes in Tennis to Tenth Grade Girls" (unpublished Master's thesis, California State College, 1968).

¹²Anthony Annarino, "IIP," Journal of Health, Physical Education and Recreation, XLIV (October, 1973), 20.

PERSONALITY FACTORS AND COGNITIVE LEARNING

Little research has been done in the area of personality and the educational process, according to Cattell, Eber, and Tatsouka.¹³ In 1966, their study found that rates of learning in specific and general areas are related to personality factors at the child level. This specific study indicated that learning gain over a year was related to superego strength and low self-sufficiency (Factor Q₂ of 16PF). Also, Haggard¹⁴ stated that academic achievement, in general, is one of the many expressions to which children are responsive and achievement is related to personality structure.

Personality-intellectual studies have been conducted through the United States Office of Education. In 1968, a grant supported a study by Szabo and Feldhusen¹⁵ concerning the relationship of intellectual and personality variables to success in an independent study science course. The

¹³Raymond B. Cattell, Herbert W. Eber, and Maurice M. Tatsouka, Handbook for the Sixteen Personality Questionnaire 16PF (Champaign, Illinois: Institute for Personality Testing, 1970), p. 237.

¹⁴E. G. Haggard, "Socialization, Personality and Academic Achievement in Gifted Children," School Review, LXV (Winter, 1957), 391.

¹⁵Michael Szabo and John F. Feldhusen, "An Investigation of the Relationship of Intellectual and Personality Variables to Success in an Independent Study Science Course Through Use of a Modified Multiple Regression Model," ED 042803 (Washington, D.C.: ERIC Clearinghouse, 1968), pp. 1-6.

Guilford-Zimmerman Temperament Survey was administered to undergraduate freshman and sophomore subjects enrolled in a one-semester biological science course taught on an independent study basis. Results of the study demonstrated that successful performance in an independent study biological course is correlated with the personality trait of restraint (the capacity to be serious minded).

In 1961, Jones¹⁶ discussed neuroticism (anxiety) and cognitive learning. He stressed that neuroticism implied a low tolerance for stress, whether it be physical or psychological. Also, Jones stated that, in learning theory terms, an individual scoring high on the neuroticism factor would be characterized by a high drive level.

Waite, Sarason, Lighthall, and Davidson¹⁷ selected high and low anxious groups. The subjects in this study were 747 elementary students in grades two through five who performed a paired-associates learning task. Excluded were those students regarded by their teacher in arithmetic, reading or behavior problems, and those whose parents were separated or divorced. No difference in performance was

¹⁶H. G. Jones, "Learning and Abnormal Behavior," ed. H. J. Eysenck, Handbook of Abnormal Psychology (New York: Basic Books, 1961), p. 492.

¹⁷Richard R. Waite, Seymour B. Sarason, Frederick F. Lighthall, and Kenneth S. Davidson, "A Study of Anxiety and Learning in Children," Journal of Abnormal and Social Psychology, LVII (July-November, 1958), 267-270.

found between the high and low anxious group; however, the girls appeared to be somewhat better than the boys. In another paired-associates learning task, Standish and Champion¹⁸ selected low, medium, and high drive individuals, utilizing the Taylor Manifest Anxiety Scale. The subjects were 63 students taking a psychology course at the University of Sydney. It was revealed that the high drive subjects performed better on difficult tests. In another paired-associates task, Saltz and Hoehn¹⁹ found that high anxiety subjects' performance fell as the paired-associates learning task difficulty was increased. The subjects were airmen at the Air Force Personnel and Training Research Center at Chanute Air Force Base, Illinois. These airmen were tested on the Taylor Manifest Anxiety Scale. The upper and lower 20 percent of the subjects were selected for use in the study.

Sarason²⁰ indicated that high anxious subjects scored better on cognitive learning than low and middle anxious subjects through the use of motivational

¹⁸R. R. Standish and R. W. Champion, "Task Difficulty and Drive in Verbal Learning," Journal of Experimental Psychology, LIX (June, 1960), 361-365.

¹⁹Eli Saltz and Arthur Hoehn, "A Test of the Taylor-Spence Theory of Anxiety," Journal of Abnormal and Social Psychology, LIV (July, 1957), 114-124.

²⁰Irwin G. Sarason, "Effect of Anxiety, Motivational Instructions and Failure on Serial Learning," Journal of Experimental Psychology, LI (April, 1956), 253-260.

instructions. The task was a serial-learning, nonsense, syllable task. Later, in a similar study, Sarason²¹ obtained the same results with the high anxious subjects outscoring the low and middle anxious subjects. The subjects for Sarason's study were drawn from the middle 20 percent of the Taylor Manifest Anxiety A. Scale distribution for 530 students in introductory psychology at Indiana University.

Truax and Martin²² investigated the performance of high and low anxious subjects on a simple adding task. The task involved a pre-planned failure on a digit symbol task given immediately before a simple adding task. These subjects were tested on the Taylor Manifest Anxiety Scale. Wittrock and Husek²³ found that high anxiety undergraduate subjects scored significantly higher on retention of a complete passage of Buddhism who learned the material immediately before a mid-semester examination than for low anxiety undergraduate subjects who learned the material

²¹Irwin G. Sarason, "The Effect of Associate Value and Differential Motivating Instructions on Serial Learning," American Journal of Psychology, LXX (December, 1957), 620-623.

²²Charles B. Truax and Barclay Martin, "The Immediate and Delayed Effect of Failure as a Function of Task Complexity and Personalization of Failure," Journal of Abnormal and Social Psychology, LV (July, 1957), 16-20.

²³M. C. Wittrock and T. R. Husek, "Effect of Anxiety Upon Retention of Verbal Learning," Psychological Abstracts (February, 1963), 79, C. M. Louttit, ed., XXXVII, Abstract No. 455.

during a regular class. Again, the test used was the Taylor Manifest Anxiety Scale.

In another study involving 154 students in introductory psychology, Mandler and Sarason²⁴ found that a group of high anxious subjects scored higher than low anxious subjects on the Kohs Block Design Test on initial trials. After a series of trials, however, the high anxious subjects had lower scores than the low anxious subjects.

PERSONALITY FACTORS AND PSYCHOMOTOR LEARNING

There is considerable literature in regard to motor skill tasks and the learning of motor skills. Most of the research completed in this area, however, has failed to take into account the effects of personality variables on motor skill learning.

In his text, Dimensions of Personality, Eysenck²⁵ discussed the work of noted theorists who dealt with the concepts of introversion and extroversion. Eysenck concluded that the extrovert shows a higher degree of behavioral activity, while the introvert shows a tendency to exhibit self-control.

²⁴George Mandler and Seymour B. Sarason, "A Study of Anxiety and Learning," Journal of Abnormal and Social Psychology, XLVII (April, 1952), 166-172.

²⁵H. J. Eysenck, Dimensions of Personality (London: Kegan-Paul, 1947), pp. 57-58.

There is some evidence that introverts tackle tasks slowly and accurately while extroverts are quick and inaccurate, according to Lynn and Gordon.²⁶ The performance of extroverts and introverts on a simulated driving test was investigated by Drew, Colquhoun, and Long.²⁷ Both speed and accuracy were observed. The findings indicated that extroverts made more errors in their performance. Foulds²⁸ reported similar findings in a study of the performance of extroverts on the Porteus mazes. His findings indicated that introverts were more careful in their response, thus making fewer mistakes.

Eysenck²⁹ completed some twenty studies to test his hypothesis that extroverts would show greater short-term retention than introverts on pursuit motor tasks. The procedure involved a practice period of five minutes followed by a ten-minute rest period. Eysenck reported that

²⁶R. Lynn and I. E. Gordon, "The Relationship of Neuroticism and Extroversion of Intelligence and Educational Attainment," British Journal of Educational Psychology, XXXI (April, 1961), 196.

²⁷G. C. Drew, W. P. Colquhoun, and H. Long, "Effect of Small Doses of Alcohol on a Skill Resembling Driving," British Medical Journal, II (September, 1958), 993-999.

²⁸G. A. Foulds, "Temperamental Differences in Maze Performance," British Journal of Psychology, XLIII (February, 1952), 33-44.

²⁹H. J. Eysenck, "Reminiscence, Drive and Personality: Revision and Extension of a Theory," British Journal of Social and Clinical Psychology, I (January, 1962), 127-140.

in nearly every case the results demonstrated that the extroverts showed greater short-term retention effects.

The indication of a quick response for extroverts in the previous studies may in some way be related to findings which indicate that in tasks requiring sustained attention extroverts began as efficiently as introverts, but soon afterwards began to show inattention and work decrement. An investigation by Lynn³⁰ showed that extrovert subjects began as slowly as introvert subjects, but showed greater work decrement as the task proceeded. The instrument used was the Maudsley Personality Inventory. The task was an inverted alphabet printing task under massed practice conditions, and the subjects were 46 male, university students living in university housing.

The level of skill in a testing situation has an important place in motor skill learning, according to Eysenck.³¹ He states that the few studies that have been completed indicate that both short and long retention performances are raised by increased drive. Eysenck investigated the performance of 600 subjects on a pursuit motor task. His findings indicated that the high drive subjects had significantly higher performances.

³⁰R. Lynn, "Extroversion, Reminiscence and Satiation Effects," British Journal of Psychology, LI (April, 1960), 319-324.

³¹H. J. Eysenck, Experiments in Motivation (New York: The Macmillan Co., 1964), p. 37.

Maltzman, Smith, and Brooks³² studied the response of high and low anxiety subjects on a target-tracking task. Findings indicate that high anxiety subjects scored a higher number of hits, while low anxiety subjects scored relatively few hits. The speed of response of neurotics (anxiety) on the Porteus Mazes test was studied by Foulds and Caine.³³ They found tendencies for neurotics to perform more quickly than non-neurotics in the maze tests.

PERSONALITY TRAITS OF ATHLETES

In a review of the empirical literature concerning the relationship between athletes and personality variables, Cooper³⁴ noted there was a greater motivation to achieve among athletes than among non-athletes. Cooper concluded that, generally, personality features of athletes point to greater social adjustment and higher emotional stability.

³²I. Maltzman, W. M. Smith, and W. O. Brooks, "Some Effects of Different Training Conditions and Manifest Anxiety Upon Target Tracking," Psychological Abstracts (August, 1956), 502, C. M. Louttit, ed., XXX, Abstract No. 5642.

³³G. A. Foulds and T. M. Caine, "Psychoneurotic Symptom Clusters, Trait Cluster and Psychological Tests," Journal of Mental Science, CIV (June, 1958), 722-731.

³⁴Lowell Cooper, "Athletics, Activity and Personality, A Review of the Literature," Research Quarterly, XXXX (March, 1969), 17-21.

Rushall³⁵ tested over 2,000 athletes and found that many types of individuals participated in sports. He concluded that personality was not a significant factor in sport performance. Comparisons of levels of performance within a sport, and between and across environments within a sport, were made for football, swimming, baseball, and basketball. For example, no characteristic set of traits emerged to support the hypothesis that football players have distinct personalities, according to results of Form A of the 16PF.

Another study reflected a contrasting finding which indicates general sports personality characteristics do exist, according to Ogilvie and Tutko.³⁶ These researchers developed the Athletic Motivation Inventory (AMI) which measures eleven traits common to most successful sports figures. This inventory has been administered to 15,000 athletes, and the results indicate that general sports personalities do exist, which led Ogilvie and Tutko to make the following statements:

³⁵Brent Rushall, "An Evaluation of the Relationship Between Personality and Physical Performance Categories," ed. G. S. Kenyon, Contemporary Psychology of Sport (Washington, D.C.: International Society of Sport Psychology, 1968), pp. 157-165.

³⁶Bruce C. Ogilvie and Thomas A. Tutko, "If You Want to Build Character, Try Something Else," Psychology Today, V (October, 1971), 61-63.

Athletes who survive the high attrition rate associated with sports competition are characterized by all or most of the following traits: (1) They have great need for achievement and tend to set high but realistic goals for themselves and others. (2) They are highly organized, orderly, respectful of authority and dominant. (3) They have large capacity for trust, great psychological endurance, low-resting levels of anxiety and slightly greater ability to express aggression. Most athletes indicate low interest in receiving support and concern from others, low need to take care of others, and low need for affiliation. Such a personality seems necessary to achieve victory over others. There is some question whether these trends are temporary character traits--changing when the athlete gets out of sports--or permanent ones.³⁷

The 16PF was administered to football players from a small state-supported college, a small private college, an Ivy League university, and a Big-Ten university. Straub³⁸ suggests there is a difference in the personality profile of football players competing in different levels of competition.

Williams³⁹ investigated the personalities of female fencers. The findings indicated that, among female fencers, the top level competitor was significantly more dominating than the low level competitor.

³⁷Ogilvie and Tutko, pp. 61-62.

³⁸William F. Straub, "Personality Traits of College Football Players Who Participated at Different Levels of Competition," International Journal of Sport Psychology, II (1971), 33-41.

³⁹J. M. Williams, "Personality Traits of Champion Level Female Fencers" (unpublished Doctoral dissertation, University of Alabama, 1969), p. 446.

Studies by Ogilvie⁴⁰ suggested that personality factors of the highly skilled athletes intensify as they move to higher levels of successful competition. Ogilvie reported that his findings suggest there seemed to be a shift from intercollegiate sport in such traits as autonomy and deference, with the professional becoming less autonomous and more deferential.

Singer⁴¹ studied the personalities of skilled athletes in an investigation involving the intercollegiate tennis and baseball athletes of Ohio State University. Both groups were given the Edwards Personal Preference Schedule. Comparisons were made between the sports and between the lowest skilled and highest skilled athletes in both groups. Results showed no significant difference between participants in tennis and baseball. Also, Singer inferred that one was not able to distinguish between the higher and lesser skilled athletes in terms of personality.

Other studies have indicated differences between individual and team participant personalities. A study by

⁴⁰Bruce C. Ogilvie, "What Is An Athlete?", Journal of Health, Physical Education and Recreation, XXXVIII (June, 1967), 48.

⁴¹Robert N. Singer, "Personality Differences Between and Within Baseball and Tennis Players," Research Quarterly, XL (October, 1969), 588.

Peterson, Weber, and Trusdale⁴² indicated significant differences between highly skilled women who were participants in individual sports and those who were team sport participants. The 16PF was administered to 97 female Olympic and AAU competitors. The individual and team sport participants were significantly different on seven of the sixteen personality factors. The individual sports participants were more dominant and aggressive, adventurous, sensitive, imaginative, radical, self-sufficient, and resourceful, but were less sophisticated than team sport participants.

The California Psychological Inventory was administered to non-athletes and athletes in the ninth and twelfth grades and on the college level by Schendel.⁴³ His findings showed that ninth- and twelfth-grade athletes generally possessed more desirable personal-social psychological characteristics than non-athletes. On the college level, Schendel found that the non-athletes generally possessed more desirable characteristics than athletes.

⁴²Sheri Peterson, Jerome Weber, and William Trusdale, "Personality Traits in Team Sports Versus Individual Sports," Research Quarterly, XXXVIII (December, 1967), 687.

⁴³Jack Schendel, "Psychological Differences Between Athletes and Nonparticipants in Athletics at Three Educational Levels," Research Quarterly, XXXVI (March, 1965), 52-67.

Athletes and non-athletes at the United States Military Academy were administered the 16PF by Werner and Gottheil.⁴⁴ A group of 340 entering cadet athletes were significantly different from 116 entering cadet non-athletes. The incoming athletes were more outgoing (A+), more enthusiastic and happy-go-lucky (F+), more adventurous (H+), more conservative (Q₁-), more group dependent (Q₂-), had more undisciplined self-conflict (Q₃-), and were more tense and excitable (Q₄+) than the incoming non-athletes. All cadets, upon entering the Academy, participated regularly in an intensive athletic program; there, it was hypothesized that the prior non-participants or designated non-athletes would change in personality structure more than the athletes. However, after four years of regular athletic participation, the designated non-athletic group was not found to change in personality structure as measured by the 16PF.

SUMMARY

The studies involving programmed tennis instruction found no significant difference in methodology. Some of the other studies did have significant findings when comparing various other tennis teaching methods.

⁴⁴Alfred C. Werner and Edward Gottheil, "Personality Development and Participation in College Athletics," Research Quarterly, XXXVII (March, 1966), 126-131.

Much attention has been directed toward identification of specific personality factors among athletes. The studies fail to agree as to the existence of distinct personalities in athletes and between the various sports. In some cases, the studies reported distinct personalities in athletes; however, other studies found no characteristic set of traits emerging to support the hypothesis that athletes have distinct personalities.

The literature review in this chapter leads to the general conclusion that learning in both the cognitive and psychomotor domain is related to selected personality aspects. For the most part, high drive and high anxious subjects seem to demonstrate better motor and cognitive performance. Also, extroverts seem to show better performance in cases involving motor speed performance, while introverts demonstrate more accuracy. However, these studies involving psychomotor learning and personality are based entirely on research in the psychological field involving small skill tasks. None of the psychomotor-personality investigations have involved motor skill learning in the realm of physical education.

Due to the scarcity of such studies in physical education, the review of literature did not include studies which dealt with the combinations of multiple teaching methods, motor skill growth, and personality identification.

A few physical educators suggest the possibility of creating successful learning environments based on these components. Up to this point, little interest has been directed toward such studies; therefore, it is due to the lack of such evidence that initiated the interest for the present study.

Chapter 3

METHODS AND PROCEDURES

The operational design for this investigation included: (1) description of subjects, (2) experimental periods, (3) instructional groups, (4) test instruments, (5) procedures for data collection, and (6) testing and instructional facilities.

DESCRIPTION OF SUBJECTS

The subjects in this study were sixty-three men and women students enrolled for academic credit in beginning tennis classes at Calhoun Community College in Decatur, Alabama, during the 1974 fall term. These subjects were distributed among four tennis classes, of which two classes comprised a control group while the remaining two classes served as an experimental group.

Selection of subjects was based on information provided by a personal data form. All subjects completed the information form during the first class meeting. The personal data form provided information for elimination of subjects who: (1) had previous high school, college or professional tennis instruction; (2) had played tennis more

than fifteen times during the past two years; and (3) failed to fall within the age range of eighteen through twenty-two years of age.

EXPERIMENTAL PERIOD

The experimental period was conducted in conjunction with regular class meetings and ran a total of thirteen 50-minute class meetings, excluding rainy days. Classes met two times each week. The experimental period was distributed as follows:

1st Meeting--Orientation course, explanation of experiment, question and answer period, completion of personal data forms and explanation of dress apparel and use of dressing rooms.

2nd-3rd Meetings--Administration of the Hewitt Tennis Achievement Test, Broer-Miller Forehand-Backhand Drive Test and the 16PF.

4th-12th Meetings--Subjects in programmed and traditional groups covered the three tennis skills in accordance with the methodological approach used in their respective sections.

13th Meeting--Readministration of the tennis skills tests.

All absences which occurred during the study period were made up by all subjects who finished this study. The

tennis courts were reserved on Fridays for subjects to do make-up work during the same regularly scheduled hour. The instructor was present at all make-up work periods.

INSTRUCTIONAL GROUPS

The experimental group and control group were derived from four tennis classes which were within the normal physical education activity course offering at Calhoun Community College. A method of instruction was assigned to each class by use of a table of random numbers.¹ The experimental group utilized programmed instruction, while the control group was instructed by the traditional teacher-directed approach. All subjects were asked not to participate in tennis practice except during the designated instructional periods.

EXPERIMENTAL GROUPS

The experimental group was instructed through utilization of an individualized programmed tennis guide. More specifically, this programmed tennis guide was Tennis

¹Herbert Arkin and Raymond Colton, Tables for Statisticians (New York: Barnes & Noble, Inc., 1963), pp. 153-161.

Individualized Instruction Program by Anthony Annarino.²

Parts I, II, and IV of Tennis Individualized Instruction Program were utilized, which include: (1) Part I--The Forehand Stroke and Grip; (2) Part II--The Backhand Stroke and Grip; and (3) Part IV--The Serve (see Appendix C).

Programmed Instructional
Technique

All subjects in the programmed group were informed by the instructor that progression in the programmed material was to be made at an individualized rate in attempting to cover the material. The instructor reminded all subjects not to be overly concerned that progression was being made throughout the class on differing individual ability levels. The instructor strongly encouraged each subject to be responsible in setting his or her pace in attempting to cover the specified programmed frames. Primarily, each student was responsible for attempting to cover as much of the programmed material as possible in each of the three period skill units. The subjects were informed that their class grades would not be jeopardized if their guide was incomplete.

The tennis skill units were planned in the following manner: (1) forehand stroke and grip--three 50-minute class

²Anthony Annarino, Tennis Individualized Instruction Program (Englewood Cliffs: Prentice-Hall, Inc., 1973), pp. 15-73.

meetings; (2) backhand stroke and grip--three 50-minute class meetings; and (3) service--three 50-minute class meetings.

Instruction of the programmed classes is typified by the following manner:

First Day of Class--Forehand Stroke and Grip.

(1) As class began, all subjects gathered in a designated gymnasium classroom. The instructor provided a short film loop consisting of the proper execution of the forehand grip and stroke (5-7 minutes).

(2) All subjects and the instructor then journeyed to the tennis courts and gathered in a small group near the courts' entrance. The instructor introduced the forehand drive by describing the forehand stroke objectives. Then the instructor reexamined some important points in the film loop.

(3) The instructor demonstrated the skill several times, in a step-by-step approach. First, the proper Eastern Forehand Grip was demonstrated, etc. Then the instructor provided the "whole" skill demonstration.

(4) Each subject was given a programmed tennis guide by the instructor (see Appendix C). Procedures for using the guide were presented, which included special emphasis that each subject understand that progress was to be made on an individual basis. Subjects were asked not to hurry

through the frames. Emphasis was also stressed that each subject should complete each frame before attempting the next frame; in other words, subjects should not skip frames. Self-responsibility was stressed.

(5) All subjects were asked to choose a partner and begin following the programmed tennis guide. Also, the class was informed that the instructor would be available for assistance upon student request. The instructor circulated about the tennis courts and assisted only those subjects requesting instructor assistance.

Second and Third Class Meetings--Forehand Stroke and Grip.

(1) The class assembled in a small group at the court entrance. The instructor reviewed the past lesson and provided tips to improve obvious existing weaknesses that seemed to be characteristic of beginning tennis players. A short question and answer session was held. Then the subjects were asked to adjourn to the courts and begin following their programmed guides. The instructor walked about the courts providing helpful information to those subjects seeking instructor assistance.

Some subjects finished the programmed guide prior to the end of each designated three-period unit. In such an event, these subjects were instructed to practice that particular skill by themselves or with another subject who

had also finished the guide. Some subjects did not finish the programmed material in the allotted three periods. In this event, the instructor informed these subjects to discontinue working on that particular skill unit. At this point, the entire class proceeded to the next skill unit. Subjects did not spend extra time attempting to finish incompleated programmed frames. The majority of subjects completed each programmed unit within fifteen minutes of each other.

Control Group

The control group was instructed through utilization of the teacher-directed traditional method.

Traditional Instructional Technique. For purposes of this study, traditional instruction consisted of an oral description of each tennis skill, followed by a practical demonstration and supplemented by films. The primary emphasis of traditional instruction was physical practice on a trial and error basis by subjects practicing individually or in small groups. The instructor encouraged subjects to ask questions and seek assistance concerning the various tennis skills. Also, the instructor walked about the tennis courts, observing subjects and providing assistance to those subjects seemingly needing such assistance.

The tennis skill units were planned in the following manner: (1) forehand stroke and grip--three 50-minute class

meetings; (2) backhand stroke and grip--three 50-minute class meetings; and (3) service--three 50-minute class meetings.

The following procedure is characteristic of the instruction given during traditional instruction of the forehand drive:

First Class Meeting--Forehand Stroke and Grip.

(1) As class began, all subjects gathered in a designated gymnasium classroom. The instructor provided a short film loop consisting of the proper execution of the forehand grip and stroke (5-7 minutes).

(2) All subjects and the instructor then journeyed to the tennis courts and gathered in a small group near the courts' entrance. The instructor introduced the forehand drive by describing the objectives. Then the instructor reexamined some important points in the film loop.

(3) The instructor demonstrated the skill several times in a step-by-step approach. First, the proper Eastern Forehand Grip was demonstrated to the subjects. Next, the instructor demonstrated the proper feet position, stance, backswing, swing, and follow-through.

(4) A detailed description of the demonstration is as follows: (The instructor positioned the group so as to allow the subjects enough space to swing their rackets.) The instructor then verbally directed the class to go

through the step-by-step approach to the forehand grip and stroke. After repeating the step-by-step approach several times, the subjects were told to familiarize themselves with the "whole skill."

(5) The class was then asked to break up into pairs, three's, or four's and go to the various courts and practice that skill. The subjects were also asked to offer constructive criticism to their partners.

(6) The instructor walked about the tennis courts observing subjects practicing and offering helpful hints and other advice to those subjects who seemingly needed such advice.

Second and Third Class Meetings--Forehand Stroke and Grip.

All subjects were gathered on the tennis courts at the entrance and situated in a small group. The instructor provided a brief review of the past lesson. The instructor reemphasized certain weaknesses that appeared to be common among beginning tennis players such as failure to properly execute a follow-through after hitting the ball. In general, the instructor provided directions, demonstrations and helpful hints on the forehand drive and answered questions from subjects.

The instructor then asked the subjects to pair off or get in three's or four's and practice the forehand drive.

Again, the subjects were asked to offer constructive criticism to their partners for improvement on the forehand drive. The instructor circulated about the courts offering suggestions for improvement.

DESCRIPTION OF TEST INSTRUMENTS

Testing instruments used for the gathering of data included: (1) Cattell's Sixteen Personality Factor Questionnaire 16PF,³ (2) Broer-Miller Forehand-Backhand Drive Test,⁴ and (3) Hewitt's Tennis Achievement Test--speed of service.⁵

Cattell's Sixteen Personality Factor Questionnaire 16PF

The 16PF personality questionnaire utilized in this study is used extensively by physical educators for research purposes. The test designer, Raymond Cattell,⁶ indicates

³Raymond Cattell, Herbert Eber, and Maurice Tatsouka, Handbook for Sixteen Personality Factor Questionnaire 16PF (Champaign, Illinois: Institute for Personality and Ability Testing, 1970), pp. 60-111.

⁴Marion Broer and Donna Miller, "Achievement Tests for Beginning and Intermediate Tennis," Research Quarterly, XXI (October, 1950), 307-313.

⁵Jack Hewitt, "Hewitt's Tennis Achievement Tests," Research Quarterly, XXXVII (May, 1966), 231-240.

⁶Raymond Cattell, The Scientific Analysis of Personality (Baltimore: Penguin Books, Inc., 1965), p. 28.

that the 16PF measures an individual's response which reflects not only the situation in which he is placed but also the relatively enduring nature of his personality. It attempts to cover planfully and precisely all the main dimensions along which people can differ, according to basic analytic research. In the 16PF, Cattell describes personality by assigning scores on a spectrum of traits which are relatively permanent broad tendencies of behavior (see Appendix E).

The early editions of the 16PF were criticized for low reliabilities and lack of objective evidence for claims made by the author. Other early criticisms were for the speculative nature of the validity reported and lack of correlation of the factor scores with other personality measures.⁷ However, a review by Bouchard⁸ did have some good things to say about the new handbook:

The rich store of "specifications equations" (regression equations), normative data, and occupational profiles are a psychometrician's delight and provide the major justification for using this test.

⁷Oscar K. Buros, ed., The Fourth Mental Measurements Yearbook (Highland Park, N.J.: The Gryphon Press, 1953), pp. 147-149.

⁸Oscar K. Buros, ed., The Seventh Mental Measurements Yearbook (Highland Park, N.J.: The Gryphon Press, 1972), p. 329.

Fisher⁹ gives a favorable review of the 16PF based on its usefulness as a clinical tool. According to Fisher, a tremendous amount of theoretical and practical research underlies Cattell's 16PF, and he adds that the test appears to be methodologically superior to all other personality questionnaire tests.

There are five forms of the 16PF which are Forms A, B, C, D, and E. The first four forms are most appropriate for literate individuals whose educational level is equivalent to that of the average high school student. Form E is available for those individuals with marked educational and reading deficiencies.

Form A (1972 edition) which was used in this study is composed of 187 items with ten to thirteen items for each of the sixteen factors. There is a time requirement of forty-five to fifty-five minutes for the test administration. The test is easily administered and easily hand or machine scored. It is a trichotomous answer test in which the subject selected the answer "Yes," "In Between," or "No."¹⁰ Tables are provided in the Tabular

⁹Robert Fisher, "Special Test Reviews of the 16PF Questionnaire," Journal of Clinical Psychology, XII (October, 1956), 408-411.

¹⁰Institute for Personality and Ability Testing, Manual for the 16PF (Champaign, Illinois: Institute for Personality and Ability Testing, 1972), pp. 8-9.

Supplement¹¹ to convert raw scores to sten scores. The average scores or "Normal" range is defined by Cattell as one sigma range centered on the mean and is represented by stens 5 and 6. Only when a score is in the sten of 4 or 7 is an individual considered as definitely departing from the average. High and low score descriptions for individuals departing from the average are provided in Appendix F. Profiles for college populations can be drawn from a combination of all sixteen personality factors.

Cattell, Eber, and Tatsouka report the reliability for the 16PF Form A in the form of split-half consistency coefficients based upon test-retest with a two- to seven-day interval using a male and female high school sample. The coefficients ranged from .75 to .92 on individual scales with twelves scales exceeding .80.¹²

Broer-Miller Forehand-Backhand Drive Tests

The first objective measure of the forehand and backhand tennis drive was developed by Broer and Miller¹³ in 1950. The primary purpose in the test development was to

¹¹Institute for Personality and Ability Testing, Tabular Supplement No. 1 to the 16PF Handbook (Champaign, Illinois: The Institute for Personality and Ability Testing, 1970), p. 26.

¹²Cattell, Eber, and Tatsouka, pp. 29-39.

¹³Broer and Miller, p. 309.

point out relative weaknesses and strengths in the forehand and backhand drives. More specifically, the test was designed to measure students' ability to place forehand and backhand drives into the backcourt area (see Appendix D). It consists of hitting a given number of balls so that they pass between the top of the net and a restraining rope placed above the net, and of attempting to place these balls into the back nine feet of the court. The court was marked into the required areas that were assigned numerical values (Figure 1, Appendix B). The ball is put into play by the student bouncing the ball to himself.

Reliability has been determined by correlating the total scores of the first seven balls on the forehand plus the first seven balls on the backhand with the total score of the second seven balls on the forehand plus the second seven balls on the backhand and predicting (using the Spearman-Brown Prophecy Formula) the validity of a test twice as long. Broer and Miller report the reliability for beginning tennis players to be .80.¹⁴

The validity was computed by correlating the subjective ratings given to students by qualified tennis instructors with the students' performance on the test. These tennis instructors made comparative ratings of the students' ability according to certain standards set up by

¹⁴Broer and Miller, p. 312.

the Tennis Grading Committee. Using twenty-seven intermediate students, the correlation of the judges combined with the subjective rating with the test was .85. In the beginning tennis group of thirty-two students, the correlation between the combined subjective rating of the judges was .61. Broer and Miller provide that lower correlations are to be expected with beginning groups due to the fact that beginners are less consistent.¹⁵

Hewitt Tennis Achievement
Test--Speed of Service

Hewitt constructed an achievement test which contains three parts: (1) forehand and backhand drive tests, (2) service placement tests, and (3) speed of service test (distance the serve bounces). Hewitt found that the service placement tennis test had the highest predictive value for the varsity player, while the speed of service test had the highest predictive value for beginning players. The speed of service test was utilized in this study.

This test consists of hitting a given number of balls (ten) so that they pass between the top of the net and a seven-foot restraining rope placed above the net, and of attempting to place these balls into the proper service court. The distance the ball travels after the initial

¹⁵Broer and Miller, pp. 311-312.

bounce determines the value for this particular test¹⁶ (test description is in Appendix D). The area behind the backcourt line was marked into areas that were assigned numerical values (see court diagram in Figure 2, Appendix B).

Beginning, advanced, and varsity players were used in the test validation and establishment of achievement scales. By use of the test-retest method, the speed of service reliability was .84. Validity was ascertained by players in all ability levels being ranked in order of ability from the poorest to the highest by playing a round robin tournament. An eight-game, pro-set was used in each match, and players had to win by a two-game margin. Spearman Rho or rank difference was used in determining validity. Scores from each group were correlated with the achievement scores on the speed of service tests. Validity for the speed of service test was .89.¹⁷

PROCEDURES FOR DATA COLLECTION

The Broer-Miller Forehand-Backhand Drive Test and Hewitt's Tennis Achievement Test were administered in a pre-test and post-test manner to each subject in the study. The pre-tests were administered during the second class

¹⁶Hewitt, pp. 236-238.

¹⁷Hewitt, pp. 238-240.

meeting of regularly allotted class instruction time during the 1974 fall quarter at Calhoun Community College. The tennis courts of the same institution were used for testing purposes. Pre-tests were administered before any course content was covered, while the post-tests were given immediately after the nine 50-minute instructional periods were completed. The researcher recorded all scores on individual score cards (see Appendix B). One physical education instructor aided the writer in obtaining pre- and post-test data.

Form A of the 16PF was administered to all subjects during the third class meeting in a regular classroom environment. All subjects willingly took the personality questionnaire. The test administration and data collection were assumed by personnel within the Student Personnel and Guidance Department at the same institution. The writer did not provide subjects with information concerning individual personality evaluation.

All students completed a personal data form during the first class meeting which included: (1) name, (2) sex, (3) age, (4) college classification, (5) previous tennis instruction, and (6) number of times the student had played tennis during the last two years.

TESTING AND INSTRUCTIONAL FACILITIES

Six asphalt regulation tennis courts, set standards and nets at Calhoun Community College were utilized for instructional and testing purposes. Backboards were placed at each court and area for utilization by the programmed instruction classes. These twelve backboards were raised to a level three feet above the ground. The size of each backboard was 10' x 6' x 1" with the two following size squares painted on each: (1) 5' x 5' and (2) 4' x 4' (see Figure 3, Appendix B).

White chalk marked the target areas on the tennis courts for pre- and post-tests. Wooden poles measuring 7' x 2" x 2" and one-quarter inch rope were used for construction of the required apparatus for administration of the pre- and post-tests.

Wilson tennis balls were used for testing and instructional purposes. Subjects were required by college physical education policy to provide their own tennis rackets; therefore, there was no uniformity in regard to tennis rackets.

CHAPTER IV

ANALYSES OF THE DATA

This chapter presents the procedures used in the analyses of the data and the results of these analyses.

The statistical measurement used in this study was the joint distribution of two variables, in this case the 16PF raw scores and the differences between pre-test and post-test scores (skill growth). The 16PF raw scores were recommended for use in statistical treatment of research data.¹

In order to accept or reject the null hypotheses of this study, a coefficient of correlation² analysis was used to determine the significance of selected personality factors. In testing the hypotheses HO_1 through HO_{16} , the

¹Raymond Cattell, Herbert Eber, and Maurice Tatsouka, Handbook for the Sixteen Personality Factor Questionnaire (16PF) (Champaign, Illinois: The Institute for Personality and Ability Testing, 1970), p. 66; see, also, Institute for Personality and Ability Testing, Tabular Supplement No. 1 to the 16PF Handbook (Champaign, Illinois: Institute for Personality and Ability Testing, 1970), pp. 3-4.

²Benton J. Underwood, Carl P. Duncan, Janet Spence, and John W. Cotton, Elementary Statistics (New York: Appleton-Century-Crofts, Inc., 1954), pp. 139-150.

mode of investigation was to examine these personality factors by way of a regression curve from the best single predictor of skill growth to the worst single predictor of skill growth. A .05 rejection level was used to determine the level of significance. The Pearson r coefficient of correlation³ was utilized for statistical treatment of the data in HO₁ through HO₁₆.

In hypothesis HO₁₇, a multiple regression⁴ correlation coefficient was calculated to determine the significance of using all the personality factors as a group to predict the skill growth in programmed and traditional groups. A .05 rejection level was used to determine the level of significance of the correlation coefficient.

The analysis was completed in two parts. The Pearson r coefficients of correlation⁵ for HO₁ through HO₁₆ were computed using the IBM 370 computer at the Calhoun Community College campus in Decatur, Alabama, with a program written by Helen H. Atkins.⁶ The multiple regression

³Underwood, Duncan, Spence, and Cotton, pp. 139-150.

⁴Robert Parsons, Statistical Analysis, A Decision Making Approach (New York: Harper Publishers, 1974), pp. 277-343.

⁵Underwood, Duncan, Spence, and Cotton, pp. 139-150.

⁶Helen H. Atkins, "Coefficient of Correlation Program" (unpublished program, Calhoun Community College Statistics Library, Decatur, Alabama, May, 1975).

analysis was computed by using the multiple regression program, Behavioral Sciences Statistics Program Library,⁷ written by Harry R. Baker. This program was computed on the UNIVAC 1108 computer at the University of Alabama campus in Tuscaloosa, Alabama.

TEST RESULTS OF PROGRAMMED GROUP

Service Skill Growth

Analysis of the service skill growth in the programmed instructional environment indicated there were no significant correlations with each of the sixteen personality factors. The coefficient of correlation for the personality variables with service skill growth in the programmed setting is presented in Table 1.

The critical value for r at the .05 level of significance for 35 (N-2) degrees of freedom is .275; therefore, there was no significance for any of the personality factors since the highest correlation was .1706; hence, null hypotheses HO_1 through HO_{16} , part A-2 (service skill growth in programmed instruction), were not rejected.

⁷Harry R. Baker, "Iterative Solution for Multiple Regression and Anova-Covariance Designs," Behavior Science Statistics Program Library (Tuscaloosa, Alabama: University of Alabama Statistics Library, 1974).

Table 1

Coefficients of Correlation Between 16PF Analysis
Questionnaire Factors and Service Growth in
the Programmed Instructional Method

Factor	r
A Reserved (-) vs. Outgoing (+)	-.0957
B Less Intelligent (-) vs. More Intelligent (+)	-.1706
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.0141
E Humble (-) vs. Assertive (+)	.1581
F Sober (-) vs. Happy-go-lucky (+)	.0492
G Expedient (-) vs. Conscientious (+)	.0405
H Shy (-) vs. Venturesome (+)	.0008
I Tough-minded (-) vs. Tender-minded (+)	-.1244
L Trusting (-) vs. Suspicious (+)	.0085
M Practical (-) vs. Imaginative (+)	.1911
N Forthright (-) vs. Astute (+)	-.0262
O Self-assured (-) vs. Apprehensive (+)	-.0062
Q ₁ Conservative (-) vs. Experimenting (+)	.0053
Q ₂ Group-dependent (-) vs. Self-sufficient (+)	.1580
Q ₃ Undisciplined Self-conflict (-) vs. Controlled (+)	-.0491
Q ₄ Relaxed (-) vs. Tense (+)	-.1471

df = 35

critical value of r = .275

Forehand-Backhand Skill Growth

Subsequent analysis of the programmed method by pre-post forehand-backhand skill score differences with each of the sixteen personality factors indicated there were no significant correlations. The results of all sixteen personality factors and the r values are presented in Table 2.

Using a .05 level of rejection to determine the level of significance, none of the personality factors reached that level. The critical value for r with 35 degrees of freedom was .275. Therefore, null hypotheses HO_1 through HO_{16} , part A-1 (forehand-backhand drive skill growth in programmed instruction), were not rejected.

TEST RESULTS OF TRADITIONAL GROUP

Service Skill Growth

Analysis of the traditional instructional group indicated there was a significant correlation between Factor F- (sober) and service skill growth at the .05 level ($r = -.5006$, $df = 24$, $p < .05$). Service skill growth was also significant when correlated with personality Factor M+ (imagination) at the .05 level ($r = .3763$, $df = 24$, $p < .05$). Also, the traditional instruction method was significant with personality Factor I- (tough-minded) in

Table 2

Coefficients of Correlation Between 16PF Analysis
Questionnaire Factors and Forehand-Backhand
Skill Growth in the Programmed
Instructional Method

Factor	r
A Reserved (-) vs. Outgoing (+)	-.1738
B Less Intelligent (-) vs. More Intelligent (+)	.0363
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.0803
E Humble (-) vs. Assertive (+)	-.0120
F Sober (-) vs. Happy-go-lucky (+)	.0569
G Expedient (-) vs. Conscientious (+)	.1559
H Shy (-) vs. Venturesome (+)	.0394
I Tough-minded (-) vs. Tender-minded (+)	-.1736
L Trusting (-) vs. Suspicious (+)	.2083
M Practical (-) vs. Imaginative (+)	.1171
N Forthright (-) vs. Astute (+)	-.0325
O Self-assured (-) vs. Apprehensive (+)	.1051
Q ₁ Conservative (-) vs. Experimenting (+)	-.0498
Q ₂ Group-dependent (-) vs. Self-sufficient (+)	-.1178
Q ₃ Undisciplined Self-conflict (-) vs. Controlled (+)	.1105
Q ₄ Relaxed (-) vs. Tense (+)	.1219

df = 35

critical value of r = .275

service skill growth ($r = .3639$, $df = 24$, $p = < .05$).

These results are presented in Table 3.

In summary, personality factors F-, M+, and I- had significant correlation with service skill growth in the traditional setting. Also, the analyses of factors A, B, C, E, G, H, L, N, O, Q₁, Q₂, Q₃, and Q₄ showed there were no significant correlations between these factors and service skill growth using the traditional instructional method.

According to the analyses, null hypotheses HO₅, HO₈, and HO₁₀, part B-2 (service skill growth in the traditional method), were rejected. The remaining null hypotheses HO₁, HO₂, HO₃, HO₄, HO₆, HO₇, HO₉, HO₁₁, HO₁₂, HO₁₃, HO₁₄, HO₁₅, and HO₁₆, part B-2 (service skill growth in the traditional method), were not rejected.

Forehand-Backhand Drive Skill Growth

Analysis of the forehand-backhand drive skill growth indicated there were no significant correlations between each of the sixteen personality factors and the traditional environment. This information is presented in Table 4. The critical value for 24 degrees of freedom was .330.

Therefore, null hypotheses HO₁ through HO₁₆, part B-1 (forehand-backhand drive skill growth in the traditional method), are not rejected.

Table 3

Coefficients of Correlation Between 16PF Analysis
Questionnaire Factors and Service Skill
Growth Scores in the Traditional
Instructional Method

Factor	r
A Reserved (-) vs. Outgoing (+)	-.2382
B Less Intelligent (-) vs. More Intelligent (+)	-.0544
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.0380
E Humble (-) vs. Assertive (+)	.0477
F Sober (-) vs. Happy-go-lucky (+)	-.5066*
G Expedient (-) vs. Conscientious (+)	.2347
H Shy (-) vs. Venturesome (+)	-.2529
I Tough-minded (-) vs. Tender-minded (+)	-.3639*
L Trusting (-) vs. Suspicious (+)	-.2015
M Practical (-) vs. Imaginative (+)	.3763*
N Forthright (-) vs. Astute (+)	.2362
O Self-assured (-) vs. Apprehensive (+)	-.1913
Q ₁ Conservative (-) vs. Experimenting (+)	.0777
Q ₂ Group-dependent (-) vs. self-sufficient (+)	.3250
Q ₃ Undisciplined Self-conflict (-) vs. Controlled (+)	-.0422
Q ₄ Relaxed (-) vs. Tense (+)	-.2982

*Significant at .05 level

df = 24

critical value of r = .330

Table 4

Coefficients of Correlation Between 16PF Analysis
Questionnaire Factors and Forehand-Backhand
Drive Growth Scores in the Traditional
Instructional Method

Factor	r
A Reserved (-) vs. Outgoing (+)	.1749
B Less Intelligent (-) vs. More Intelligent (+)	.2512
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.2382
E Humble (-) vs. Assertive (+)	-.1509
F Sober (-) vs. Happy-go-lucky (+)	-.1282
G Expedient (-) vs. Conscientious (+)	.1635
H Shy (-) vs. Venturesome (+)	-.2053
I Tough-minded (-) vs. Tender-minded (+)	-.0432
L Trusting (-) vs. Suspicious (+)	.1897
M Practical (-) vs. Imaginative (+)	-.0783
N Forthright (-) vs. Astute (+)	.0526
O Self-assured (-) vs. Apprehensive (+)	.0767
Q ₁ Conservative (-) vs. Experimenting (+)	.0117
Q ₂ Group-dependent (-) vs. Self-sufficient (+)	.0879
Q ₃ Undisciplined Self-conflict (-) vs. Controlled (+)	-.0312
Q ₄ Relaxed (-) vs. Tense (+)	.1959

df = 24

critical value of r = .330

MULTIPLE CORRELATIONS

Four analyses for multiple regression were made, including: (1) the correlation between all sixteen personality factors as a group and service skill growth in the traditional setting, (2) the correlation between all sixteen personality factors as a group and forehand-backhand drive skill growth in the traditional setting, (3) the correlation between all sixteen personality factors as a group and service skill growth in the programmed setting, and (4) the correlations between all sixteen personality factors and forehand-backhand drive skill growth in the programmed setting. A summary of these results is presented in Table 5.

The value for the coefficient of correlation between all sixteen personality factors as a group and tennis service skill growth in a traditional setting was .9385. Using analysis of variance-covariance, the probability of such a value for R is .0183. Therefore, the analysis of this data indicated there is a significant correlation between all sixteen personality factors as a group for individuals who attain high scores on the total 16PF and service skill growth in the traditional instructional method. Therefore, null hypothesis HO_{17} , part D (service skill growth in the traditional method), was rejected.

Table 5
 Multiple Regression for All 16PF Factors and
 Skill Growth in Traditional and
 Programmed Instructional
 Methods

Instructional Method	Variables	Coefficient of Correlation
Traditional	16PF and Service Skill Growth	.9385*
Traditional	16PF and Forehand- Backhand Drive Skill Growth	.7044
Programmed	16PF and Service Skill Growth	.5475
Programmed	16PF and Forehand- Backhand Drive Skill Growth	.5764

*Significant at .05 level

critical level of R in traditional method = .8550 df=24

critical level of R in programmed method = .8306 df=35

Data treatment indicated no significant correlation between the sixteen personality factors as a group and the forehand-backhand drive skill scores in the traditional setting. The correlation was .7044 which did not reach the critical value of R of .8550. Null hypothesis HO_{17} , part C (forehand-backhand drive in the traditional method), was not rejected.

In the programmed settings, there were no significant correlations between all sixteen personality factors as a group and service or forehand-backhand drive skill growth scores. The correlation for the service-programmed group was .5475, while the probability of such a value for R is .8957. The correlation between the sixteen personality factors and forehand-backhand drive skill growth in a programmed setting was .5764 which does not meet the value of R of .8306. Therefore, null hypothesis HO_{17} , parts A and B (forehand-backhand drive skill growth and service skill growth in the programmed method), were not rejected.

COMPARISON OF DATA FOR TRADITIONAL AND
PROGRAMMED INSTRUCTIONAL METHODS
WITH EACH OF THE SIXTEEN
PERSONALITY FACTORS

A comparison of the coefficient of correlations for the traditional and programmed settings on each of the sixteen personality factors is presented in Tables 6 and 7.

Table 6

Comparison of Correlation Between Each 16PF Factor
and Service Skill Growth in Programmed and
Traditional Methods

Factor	Traditional	Programmed
A Reserved (-) vs. Outgoing (+)	-.2382	-.0957
B Less Intelligent (-) vs. More Intelligent (+)	-.0544	-.1706
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.0380	-.0141
E Humble (-) vs. Assertive (+)	.0477	.1581
F Sober (-) vs. Happy-go-lucky (+)	-.5066*	.0492
G Expedient (-) vs. Conscientious (+)	.2347	.0405
H Shy (-) vs. Venturesome (+)	-.2529	.0008
I Tough-minded (-) vs. Tender- minded (+)	-.3639*	-.1244
L Trusting (-) vs. Suspicious (+)	-.2015	.0085
M Practical (-) vs. Imaginative (+)	.3763*	.1911
N Forthright (-) vs. Astute (+)	.2362	-.0262
O Self-assured (-) vs. Apprehensive (+)	-.1913	-.0062
Q ₁ Conservative (-) vs. Experimental (+)	.0777	.0053
Q ₂ Group-dependent (-) vs. Self-sufficient (+)	.3250	.1580
Q ₃ Undisciplined Self-conflict (-) vs. Controlled (+)	-.0422	-.0491

Table 6 (Continued)

Factor	Traditional	Programmed
Q ₄ Relaxed (-) vs. Tense (+)	-.2982	-.1471

*Significant at .05 level

critical value of r in traditional method = .330 df=24

critical value of r in programmed method = .275 df=35

Table 7

Comparison of Correlation Between Each 16PF Factor
and Forehand-Backhand Drive Skill Growth
in Programmed and Traditional Methods

Factor	Traditional	Programmed
A Reserved (-) vs. Outgoing (+)	.1749	-.1738
B Less Intelligent (-) vs. More Intelligent (+)	.2512	.0363
C Affected by Feelings (-) vs. Emotionally Stable (+)	-.2382	-.0803
E Humble (-) vs. Assertive (+)	-.1509	-.0120
F Sober (-) vs. Happy-go-lucky (+)	-.1282	.0569
G Expedient (-) vs. Conscientious (+)	.1635	.1559
H Shy (-) vs. Venturesome (+)	-.2053	.0394
I Tough-minded (-) vs. Tender- minded (+)	-.0432	-.1736
L Trusting (-) vs. Suspicious (+)	.1897	.2083
M Practical (-) vs. Imaginative (+)	-.0783	.1171
N Forthright (-) vs. Astute (+)	.0526	-.0325
O Self-assertive (-) vs. Apprehensive (+)	.0767	.1051
Q ₁ Conservative (-) vs. Experimenting (+)	-.0117	-.0497
Q ₂ Group-dependent (-) vs. Self-sufficient (+)	.0879	-.1178
Q ₃ Undisciplined self-conflict (-) vs. Controlled (+)	-.0312	.1105

Table 7 (Continued)

Factor	Traditional	Programmed
Q ₄ Relaxed (-) vs. Tense (+)	.1959	.1219
critical value of r in traditional method = .330 df=24		
critical value of r in programmed method = .275 df=35		

The service skill growth data are presented in Table 6, and the forehand-backhand drive skill growth data are presented in Table 7.

Factors F-, I-, and M+ for the traditional group showed significant correlations with service growth. The significant correlations were: Factor F- (sober), $r = -.5066$ (.05 level of significance); Factor I- (tough-minded), $r = -.3639$ (.05 level of significance); and Factor M+ (imaginative), $r = .3763$ (.05 level of significance). The same factors did not have significant correlations with service growth in the programmed setting. Therefore, three personality factors, F-, I-, and M+, had significantly greater correlations with service skill growth in the traditional setting than in the programmed setting.

None of the 16PF factors showed significant correlations with forehand-backhand drive skill growth in either the traditional or programmed instructional environments.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The general problem of this investigation was to determine the correlation between selected personality factors and tennis skill growth in a programmed and traditional learning environment among selected groups of college men and women. Specifically, the tennis skills included the forehand drive, backhand drive, and service, while the personality factors were those specified in Cattell's Sixteen Personality Factor Questionnaire.

SUMMARY

Procedure

The sixty-three men and women subjects who participated in this study were enrolled in beginning tennis classes at Calhoun Community College in Decatur, Alabama, during the 1974 fall quarter. Four tennis classes comprised the study, of which two classes served as a control group and two classes served as the experimental group. The assignment of groups to instructional techniques was based on a table of random numbers. The experimental group numbered thirty-seven subjects who followed the programmed

method, while the control group included twenty-six students who followed the traditional methodology.

All subjects were administered pre- and post-skill tests using the Broer-Miller Tennis Drive Test, Hewitt Tennis Service Test, and Cattell's 16PF. The study period consisted of thirteen 50-minute class meetings, of which three class meetings were devoted to orientation to the study, pre- and post-skill testing, and personality testing. A period of four and one-half weeks (nine class meetings) was devoted to instruction of the three tennis skills (forehand drive, backhand drive, and service) in accordance with the methodological approach assigned the respective groups. Students were requested not to practice tennis outside the designated class periods.

Methodology Assigned to Groups

The following is a description of the teaching methodologies assigned the control and experimental groups.

Programmed Method. The experimental group was instructed by programmed instruction which was utilized through use of an individualized instruction guide. This methodology consisted of skill progression based on an individualized rate, depending on the subject's ability to cover the programmed material. Self-responsibility was

placed on each subject to realize his or her own pace in attempting to cover the specified material.

Each skill unit was organized to cover three 50-minute class periods. The first day of each skill unit consisted of an introduction to the skill, short film, demonstration, and coverage of the programmed guide by subjects. The second and third day consisted of a brief review of past material and subject progression of the programmed guide.

Traditional Method. The traditional methodology consisted of an oral explanation of the skill, short film presentation, and demonstration of each of the three tennis skills with primary emphasis placed on physical practice by the subject on a trial and error basis.

Each skill was organized into three 50-minute sessions, of which the first class would follow the pattern of oral explanation, short film and demonstration, and physical practice by subjects. The second and third class periods were devoted to physical practice by subjects in groups of two's, three's, and four's except for a short review of past material at the beginning of the class period. The instructor moved about the courts offering suggestions to subjects while they practiced.

RESULTS

Statistical treatment of the data revealed the following results:

1. There was no statistically significant correlation in the programmed method with service skill growth and any of the sixteen personality factors.

2. The data treatment did not reveal any significant correlation in the programmed method between the forehand or backhand drives skill growth and any of the sixteen personality factors.

3. There is a significant correlation in the traditional instructional method between service skill growth and the personality Factor F- (sober), Factor M+ (imaginative), and Factor I- (tough-minded).

4. Data treatment indicated no significant correlation in traditional instruction between the forehand and backhand drives skill growth and any of the sixteen personality factors.

5. There is a significant correlation in traditional instruction between service skill growth and all sixteen personality factors as a group.

6. There is no significant correlation in traditional instruction between the forehand and backhand drives skill growth and all sixteen personality factors as a group.

7. There is no significant correlation in the traditional or programmed instruction method between the service or forehand and backhand drives skill growth and all sixteen personality factors as a group.

Based on the results obtained in this investigation, the null hypotheses were answered as follow:

HO₁ A 1-2; B 1-2: Accepted, based on data analysis there was no evidence to indicate a significant correlation in either the programmed or traditional method between the service, forehand, or backhand drives skill growth and personality Factor A (reserved vs. outgoing).

HO₂ A 1-2; B 1-2: Accepted, there was no indication of a significant correlation in either the programmed or traditional methodology between the service, forehand, or backhand drives skill growth and personality Factor B (less intelligent vs. more intelligent).

HO₃ A 1-2; B 1-2: Accepted, as no significant correlation appeared in either the programmed or traditional instruction method between the service, forehand, or backhand drives skill growth and personality Factor C (affected by feelings vs. emotionally stable).

HO₄ A 1-2; B 1-2: Accepted, as the data treatment indicated no significant correlation in either programmed or traditional instruction method between the service,

forehand, or backhand drives skill growth and personality Factor E (humble vs. assertive).

HO₅ A 1-2; B 1: Accepted, as there was no significant correlation in the programmed method between the service, forehand, or backhand drives skill growth and personality Factor F (sober vs. happy-go-lucky). Also, there was no significant correlation in the traditional method between forehand and backhand drives skill growth and personality Factor F.

HO₅ B 2: Rejected, based on the significant correlation in the traditional methodology between service skill growth and personality Factor F- (sober).

HO₆ A 1-2; B 1-2: Accepted, as the data analysis indicated no significant correlation in either the programmed or traditional instruction between the service, forehand, or backhand drives skill growth and personality Factor G (expedient vs. conscientious).

HO₇ A 1-2; B 1-2: Accepted, since no statistically significant correlation was found in either the programmed or traditional methodology in the service, forehand, or backhand drives skill growth and personality Factor H (shy vs. venturesome).

HO₈ A 1-2; B 1: Accepted, as the analysis of data revealed no significant correlation in the programmed environment between the service, forehand, or backhand

drives skill growth and personality Factor I (tough-minded vs. tender-minded). Also, there was no significant correlation in the traditional method between the forehand and backhand drives skill growth and personality Factor I.

HO₈ B 2: Rejected, based on the statistically significant correlation in the traditional instruction method between service skill growth and personality Factor I- (tough-minded).

HO₉ A 1-2; B 1-2: Accepted, as there was no statistical significance evidenced in either the programmed or traditional methodologies between the service, forehand, or backhand drives skill growth and personality Factor L (trusting vs. suspicious).

HO₁₀ A 1-2; B 1: Accepted, as no significant correlation appeared in the programmed instruction method between the service, forehand, or backhand drives skill growth and personality Factor M (practical vs. imaginative). Also, there was no significant correlation in the traditional method with the forehand or backhand drives skill growth and personality Factor M.

HO₁₀ B 2: Rejected, based on the statistically significant correlation in traditional instruction between service skill growth and personality Factor M+ (imaginative).

HO₁₁ A 1-2; B 1-2: Accepted, as the data analysis revealed no significant correlation in either the programmed or traditional setting between service, forehand, or backhand drives skill growth and personality Factor N (forthright vs. astute).

HO₁₂ A 1-2; B 1-2: Accepted, as no significant correlation appeared in either the programmed or traditional environment between the service, forehand, or backhand drives skill growth and personality Factor O (placid vs. apprehensive).

HO₁₃ A 1-2; B 1-2: Accepted, since the data treatment revealed no significant correlation in either the programmed or traditional methodology with the service, forehand, or backhand drives skill growth and personality Factor Q₁ (conservative vs. experimenting).

HO₁₄ A 1-2; B 1-2: Accepted, as there was no evidence of a significant correlation in either the programmed or traditional environment with the service, forehand, or backhand drives skill growth and personality Factor Q₂ (group-dependence vs. self-sufficient).

HO₁₅ A 1-2; B 1-2: Accepted, since the analysis revealed no significant correlation in either the programmed or traditional setting between service, forehand, or backhand drives skill growth and personality Factor Q₃ (undisciplined self-conflict vs. controlled).

HO₁₆ A 1-2; B 1-2: Accepted, as there was no statistically significant evidence in either the programmed or traditional methodologies between the service, forehand, or backhand drives skill growth and personality Factor Q₄ (relaxed vs. tensed).

HO₁₇ A; B; C: Accepted, as there was no significant correlation found in the programmed method between service, forehand, or backhand drives skill growth and sixteen personality factors as a group. Also, there was no significant correlation in the traditional method between the forehand and backhand drives skill growth and all sixteen personality factors as a group.

HO₁₇ D: Rejected, since data analysis did show evidence of a significant correlation in traditional instruction between the service skill growth and all sixteen personality factors as a group.

CONCLUSIONS

Within the limitations of this study, the following conclusions seem warranted:

1. Personality factors, either separately or as a group, do not have any relationship to learning tennis skills in a programmed teaching environment.
2. The traditional teaching approach tends to provide a favorable learning environment for service skill

growth for individuals who possess the personality characteristics of sober (F-), tough-minded (I-), and imaginative (M+).

3. A traditional instructional environment enhances the learning of the service skill for individuals who have high scores on Cattell's 16PF when all personality factors are considered as a group.

DISCUSSION OF FINDINGS

Educators continue to search for fresh approaches to the teaching-learning process. The literature presented existing background studies that dealt, as closely as possible, with those variables that were used in this investigation. The literature revealed that physical educators and psychologists have shown particular interest in motor skill learning. The literature deals exclusively with either a comparison of tennis instruction methods, personality trait identification among skilled performers, namely athletes, while other studies concern personality identification in small motor skill task learning.

In discussing the findings of this investigation, one should take into consideration the lack of similar studies with which to make comparisons. The review findings were separate entities, whereas this investigation combined most of those separate entities into a single study. The

combination of two tennis instruction methods, personality and subsequent skill growth, did result in some statistically significant findings. The traditional methodology provided significant findings in tennis skill growth for specific personalities and the entire 16PF group, while there were no significant correlations within the programmed group.

A comment seems in order regarding the writer's observation of the programmed group. Although no significant correlations were found within the programmed group, this writer observed that many programmed subjects felt they more readily accomplished skill growth than in past traditional oriented classes. A common reaction to the programmed approach was that subjects felt they more accurately calculated their skill accomplishments through the programmed text. Perhaps this was due to the "newness" of the programmed material since none of the subjects had previously experienced programmed instruction in a physical education class.

RECOMMENDATIONS

Since little evidence has been previously gathered concerning the value of personality-psychomotor identification and specific physical education learning environments, this investigation, hopefully, will provide an incentive for

such interest. Also, since the writer did report some significant findings, it would seem that such findings would encourage other researchers to explore this area.

The writer hesitates to draw any generalized conclusions from one single investigation concerning placement of students in instructional environments based on personality characteristics. However, educators might become more aware of the possibilities surrounding existing personality trait differences and teaching methodology relationships. Certainly, this writer must recommend that other physical educators explore the many possibilities existing within the psychomotor learning-personality realm.

One suggestion concerning further research is that similar studies be conducted using other personality tests and teaching methods. Also, similar investigations could replace tennis skills with other skills such as badminton, bowling, handball, or specific motor skills in team sports.

APPENDIXES

APPENDIX A

RAW DATA

Table 8
Results of the 16PF
Traditional Group

Student Number	Personality Factors															
	A	B	C	E	F	G	H	I	L	M	N	O	Q ₁	Q ₂	Q ₃	Q ₄
A-1	4	7	10	12	6	9	0	16	10	6	11	16	1	16	8	17
A-2	8	7	24	11	16	14	15	7	6	15	13	4	6	11	19	3
A-3	7	7	21	19	20	7	16	10	8	6	8	16	10	15	12	18
A-4	8	10	22	21	17	16	16	16	10	20	6	12	15	11	12	9
A-5	7	6	19	20	21	14	20	5	10	11	1	4	12	8	14	12
A-6	13	8	10	8	16	7	15	2	10	18	13	14	9	10	9	21
A-7	10	4	13	10	17	14	5	14	14	9	12	19	4	7	12	24
A-8	7	10	26	21	15	19	13	8	8	16	8	1	11	18	14	8
A-9	12	7	12	10	17	18	16	12	8	8	6	12	0	9	11	22
A-10	11	6	11	4	19	15	14	16	10	6	10	8	5	6	11	17
*A-11	12	5	10	14	20	17	15	7	20	12	10	14	4	13	13	21
A-12	13	9	21	15	24	11	19	14	12	12	10	7	11	12	11	19
A-13	13	5	23	8	14	13	8	14	8	6	11	12	1	14	14	14
A-14	6	7	15	8	20	14	5	14	14	14	14	16	10	12	14	22
A-15	8	14	18	10	16	18	18	18	10	8	10	14	8	9	11	25
A-16	11	4	10	5	16	13	13	7	9	14	15	16	12	8	14	18
A-17	6	3	18	3	15	18	2	14	10	10	14	2	11	9	12	20

Table 8 (Continued)

Student Number	Personality Factors															
	A	B	C	E	F	G	H	I	L	M	N	O	Q ₁	Q ₂	Q ₃	Q ₄
A-18	14	8	18	9	18	17	16	14	2	9	13	10	3	1	14	17
A-19	12	10	19	6	21	14	11	11	11	8	13	9	9	8	16	12
A-20	18	6	18	17	24	10	20	16	10	10	10	10	6	10	12	8
A-21	16	9	5	5	12	12	8	14	4	10	10	16	4	4	10	16
A-22	9	3	14	10	19	11	17	6	11	12	10	11	13	13	11	15
A-23	8	5	9	13	15	13	5	8	12	10	6	17	11	7	12	18
A-24	6	8	15	5	16	14	16	5	11	11	9	8	4	7	15	15
A-25	7	8	13	4	10	13	6	17	2	11	14	15	6	12	10	14
A-26	14	8	15	11	19	15	13	14	4	6	10	16	12	7	15	17
A-27	8	6	13	17	12	14	13	10	5	13	10	14	10	5	8	13
A-28	11	11	15	17	13	16	8	5	8	13	12	9	7	15	12	15
A-29	6	8	10	11	6	17	10	9	12	6	5	8	12	10	12	11

*Was deleted due to practice outside designated class period.

Table 9
Results of the 16PF
Programmed Group

Student Number	Personality Factors															
	A	B	C	E	F	G	H	I	L	M	N	O	Q ₁	Q ₂	Q ₃	Q ₄
B-1	8	8	24	13	21	12	20	8	6	2	14	9	14	10	16	16
B-2	7	8	21	11	16	10	4	13	8	8	12	11	8	16	12	14
B-3	11	7	10	14	21	8	11	18	7	6	6	14	13	6	12	21
B-4	9	4	16	13	20	10	18	13	4	4	12	5	17	13	18	7
B-5	10	8	23	10	24	15	19	15	9	15	8	4	3	9	14	6
B-6	6	6	10	10	18	10	18	12	10	4	14	18	6	6	10	22
B-7	11	6	12	15	25	11	16	16	10	4	8	14	11	12	11	13
B-8	8	4	20	10	21	13	14	2	10	10	12	5	8	9	17	7
B-9	14	7	19	4	19	20	8	16	7	10	15	10	8	8	17	13
B-10	14	5	6	4	22	10	2	12	6	6	14	12	6	12	6	20
B-11	14	5	18	8	13	14	10	12	4	2	12	10	0	8	15	16
B-12	14	9	17	7	24	9	13	12	9	16	10	13	10	11	7	13
B-13	11	11	20	8	17	12	13	13	4	10	15	8	3	9	12	9
B-14	13	7	10	17	18	14	21	9	9	9	10	18	9	8	13	15
B-15	15	10	14	10	10	9	5	20	9	16	11	7	11	10	11	19
B-16	10	10	13	12	16	3	11	17	7	16	11	20	7	7	6	20
B-17	10	5	18	12	18	12	22	8	5	9	5	8	11	6	8	15

Table 9 (Continued)

Student Number	Personality Factors															
	A	B	C	E	F	G	H	I	L	M	N	O	Q ₁	Q ₂	Q ₃	Q ₄
B-18	10	7	12	6	19	13	14	14	4	13	9	9	5	5	10	17
B-19	8	5	17	10	18	14	10	14	6	12	12	13	8	16	14	12
B-20	14	9	22	4	20	13	18	12	6	14	12	14	4	5	13	13
B-21	14	8	19	4	23	14	15	13	3	15	12	9	3	3	15	7
B-22	5	7	15	12	12	14	9	5	12	12	9	13	10	12	15	8
B-23	15	8	15	5	16	8	7	16	7	10	7	9	8	9	9	13
B-24	18	9	21	18	24	13	23	16	7	19	6	11	6	8	17	8
B-25	12	8	15	10	24	4	10	16	6	16	7	11	8	11	9	18
B-26	10	7	12	8	14	11	9	7	10	8	10	13	9	8	10	7
B-27	7	5	20	12	17	5	11	3	8	9	15	7	13	12	11	8
B-28	10	6	20	14	21	4	16	7	7	10	10	4	11	12	9	10
B-29	11	10	18	7	16	15	12	11	8	10	6	9	7	13	14	9
B-30	13	8	12	13	19	9	25	10	11	5	6	13	4	5	13	5
B-31	8	8	16	16	21	14	17	9	10	13	9	16	6	5	8	22
B-32	12	9	10	11	8	10	5	14	8	3	13	16	8	14	12	15
B-33	8	6	20	8	16	14	10	14	8	8	12	12	2	12	16	12
B-34	16	6	20	10	16	16	16	20	1	11	11	9	6	14	10	12
B-35	9	6	11	11	18	6	10	16	8	8	9	14	11	7	13	12

Table 9 (Continued)

Student Number	Personality Factors															
	A	B	C	E	F	G	H	I	L	M	N	O	Q ₁	Q ₂	Q ₃	Q ₄
B-36	9	5	14	13	7	14	7	14	9	8	12	8	8	12	12	14
B-37	14	6	14	6	15	14	11	14	10	10	10	12	7	12	13	8

Table 10

**Results of Broer-Miller Forehand-Backhand Drive Test and
Hewitt Tennis Achievement Test--Speed of Service
Traditional Group**

Student Number	Broer-Miller Drive Tests			Hewitt Speed of Service		
	Pre	Post	Growth	Pre	Post	Growth
A-1	6	10	4	93	134	41
A-2	7	15	8	76	56	-20
A-3	13	14	1	67	69	2
A-4	6	9	3	81	115	34
A-5	14	17	3	90	121	31
*A-6	18			37		
A-7	7	9	2	70	111	41
*A-8	4			68		
A-9	5	11	6	44	73	29
A-10	10	10	0	39	69	30
*A-11	6			122		
A-12	1	1	0	26	45	19
A-13	1	8	7	42	108	66
A-14	1	6	5	3	43	40
A-15	5	7	2	22	71	49
A-16	5	13	8	42	92	50
A-17	2	8	6	61	71	10
A-18	7	8	1	61	93	32
A-19	10	12	2	31	74	43
A-20	2	5	3	23	52	29
A-21	7	8	1	11	49	38
A-22	6	10	4	74	113	29
A-23	6	7	1	58	97	39
A-24	8	11	3	63	119	56

Table 10 (Continued)

Student Number	Broer-Miller Drive Tests			Hewitt Speed of Service		Growth
	Pre	Post	Growth	Pre	Post	
A-25	1	9	8	47	70	23
A-26	6	7	1	53	86	33
A-27	2	13	11	79	80	1
A-28	7	21	14	67	197	80
A-29	8	16	8	104	125	21

*Was deleted due to practice outside designated class period.

Table 11

**Results of Broer-Miller Forehand-Backhand Drive Test and
Hewitt Tennis Achievement Test--Speed of Service
Programmed Group**

Student Number	Broer-Miller Pre	Drive Tests Post	Growth	Hewitt Pre	Speed of Service Post	Growth
B-1	8	8	0	34	79	45
B-2	8	9	1	103	117	14
B-3	14	14	0	82	121	39
B-4	2	6	4	45	76	31
B-5	9	13	4	91	126	35
B-6	3	3	0	24	97	73
B-7	9	10	1	39	81	42
B-8	15	17	2	49	144	95
B-9	2	4	2	2	40	38
B-10	3	5	2	20	59	39
B-11	9	10	1	32	66	34
B-12	7	10	3	48	96	48
B-13	7	7	0	49	73	24
B-14	0	6	6	76	45	-31
B-15	5	6	1	36	87	51
B-16	5	6	1	16	67	51
B-17	5	5	0	29	59	30
B-18	10	14	4	43	109	66
B-19	2	22	20	84	169	85
B-20	4	5	1	28	59	31
B-21	3	10	7	35	78	43
B-22	16	17	1	51	109	48
B-23	7	10	3	44	105	61
B-24	3	8	5	41	99	58

Table 11 (Continued)

Student Number	Broer-Miller Pre	Broer-Miller Post	Drive Tests Growth	Hewitt Pre	Speed of Post	Service Growth
B-25	17	21	4	62	83	21
B-26	8	20	12	100	128	28
B-27	10	12	2	76	117	41
B-28	6	19	13	102	113	76
B-29	5	7	2	53	129	76
B-30	4	7	3	27	68	41
B-31	8	19	11	78	140	62
B-32	2	7	5	19	70	51
B-33	5	7	1	27	58	31
B-34	7	10	3	50	67	17
B-35	1	4	3	44	66	22
B-36	0	7	7	35	70	35
B-37	4	8	4	23	64	41

APPENDIX B

**FIGURES, SAMPLES OF FORMS AND
LETTERS USED IN THE STUDY**

Figure 1

Court Markings for Broer-Miller
Forehand-Backhand Drive Test

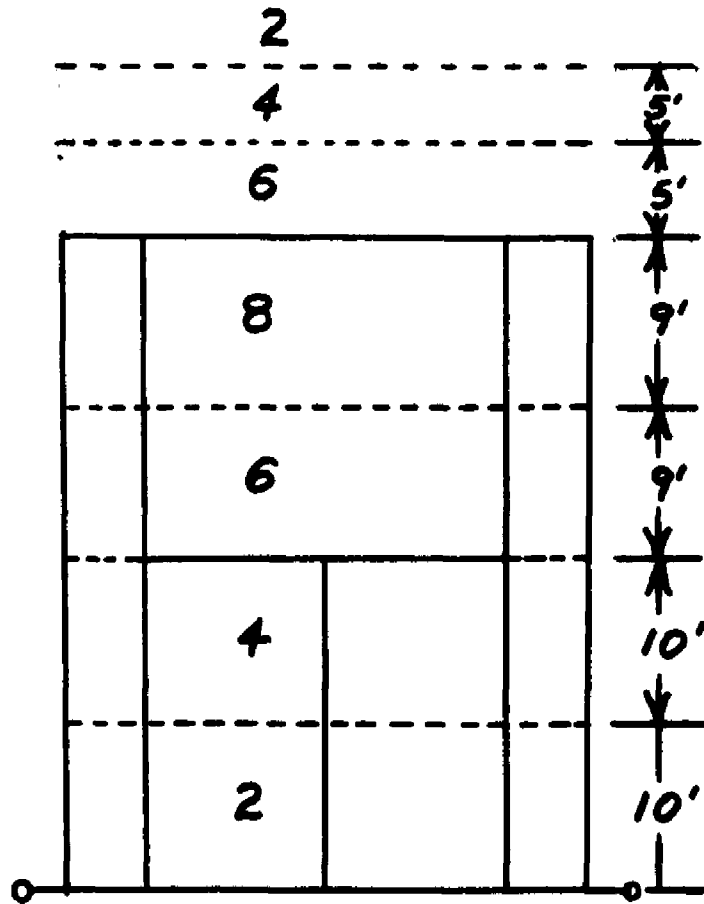


Figure 2

Court Markings for Hewitt Tennis
Achievement Test
Speed of Service

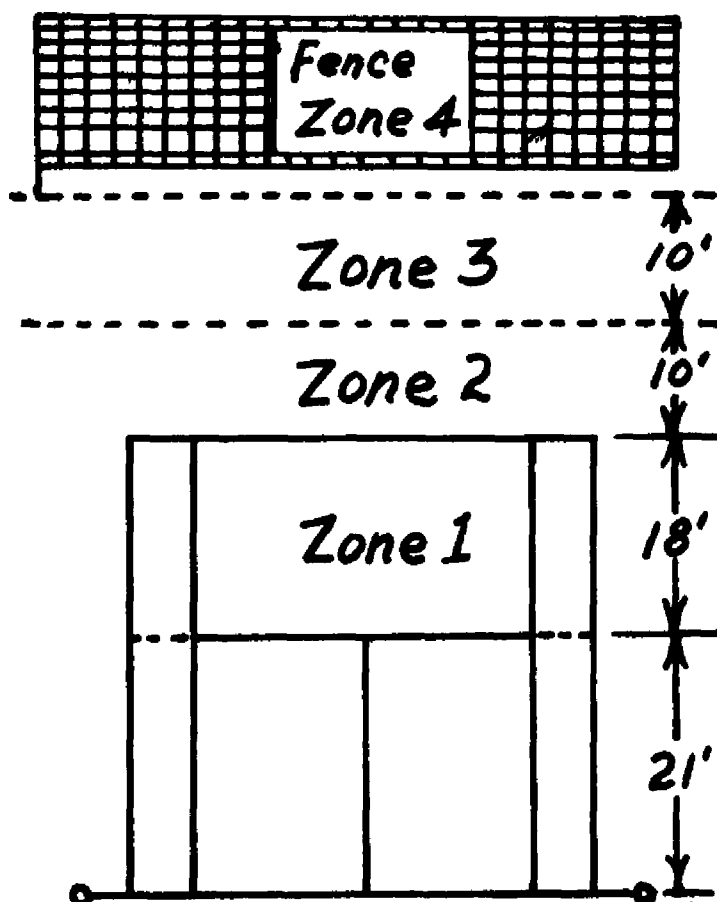
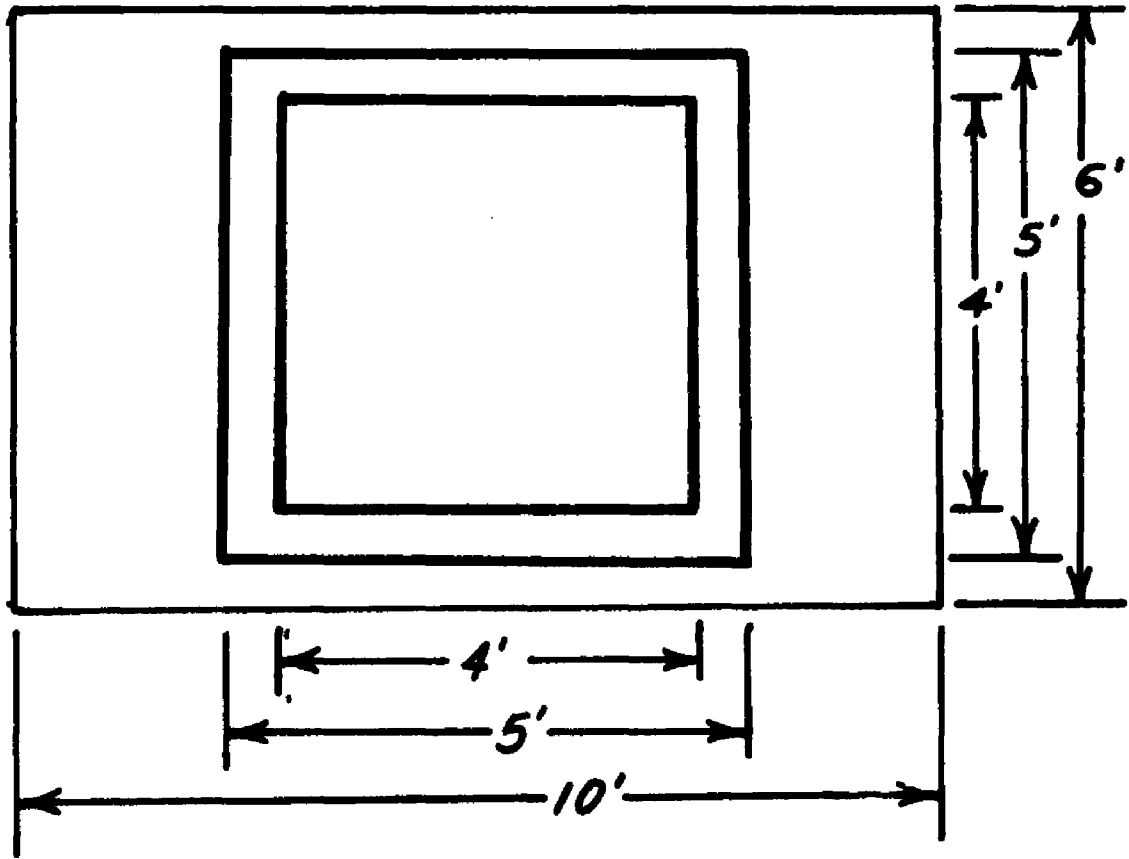


Figure 3

Tennis Backboard Diagram



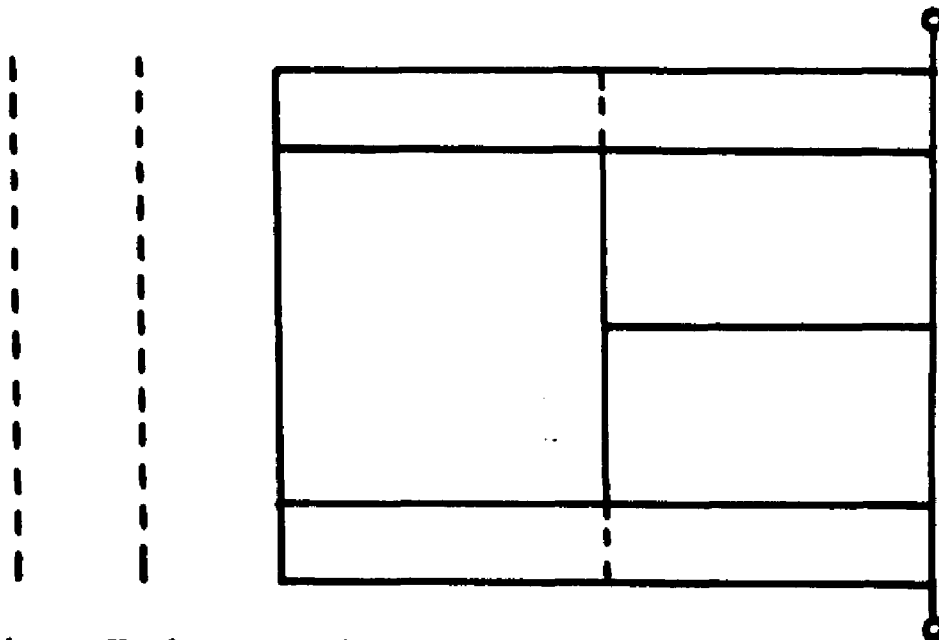
Score Card for Hewitt
Tennis Achievement
Test
Speed of Service

Name _____

Number _____

Points for good serves

- | | |
|----------|-----------|
| 1. _____ | 6. _____ |
| 2. _____ | 7. _____ |
| 3. _____ | 8. _____ |
| 4. _____ | 9. _____ |
| 5. _____ | 10. _____ |



Mark an X where good serves hit on second bounce

Sue McDonald
Department of Health, Physical
Education, Recreation and Safety
Middle Tennessee State University
Murfreesboro, Tennessee 37132

July 11, 1974

Prentice-Hall, Inc.
Englewood Cliffs, N.J. 07632

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The specific parts of the book I wish to reprint in the dissertation will be as follow: Part I--The Forehand Stroke and Grip; Part II--The Backhand Stroke and Grip; and Part IV--The Serve.

I look forward to hearing from you soon.

Sincerely,

/s/ Sue McDonald

(Mrs.) Sue McDonald



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Tel: 201-947-1000
Telex No. 13-5423

July 26, 1974

Mrs. Sue McDonald
Department of Health, Physical Education
Middle Tennessee State University
Murfreesboro, Tennessee 37130

Dear Mrs. McDonald:

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Lauretta Bonnell

(Mrs.) Lauretta Bonnell
Permissions Editor Assistant
Box 901

APPENDIX C

**TENNIS INDIVIDUALIZED INSTRUCTIONAL PROGRAM
PARTS I, II, AND IV**

Permission has been secured for reprint of the following material.

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TENNIS INDIVIDUALIZED INSTRUCTIONAL PROGRAM

INTRODUCTION

Tennis is a sport that can be enjoyed by any age group. It is an excellent recreational and competitive sport. It is a demanding sport requiring good physical condition and skill.

Your enjoyment from tennis, as a spectator or participant, will depend upon your ability to understand and skillfully play the game.

Skill does not come easily. If you have a strong desire and play yourself to thoroughly complete the assignments in this program, you can become a skillful tennis player.

This individualized instructional program is designed for you to achieve a high degree of physical condition, to develop the tennis skills, and to have an understanding of tennis strategy.

PRACTICE PROCEDURES

Do not hurry through the specific skill assignments. Try to perfect each specific skill before you progress to the next one. Work at your own pace. Do not be too concerned about your classmates' progress.

If you have difficulty in understanding or doing the skill assignments, do not hesitate to discuss it with the instructor.

When you are working with a partner, your primary concern should be to develop and master each skill and not in winning. You will be given opportunities to compete against your classmates later in the course.

PART I

SKILL: THE FOREHAND STROKE AND GRIP

STUDENT INFORMATION:

The forehand stroke is the most widely used tennis stroke. It is the easiest stroke to learn because the ball is hit from the right side of the body. (If you are right handed). It is the main attacking stroke in a tennis match.

PURPOSE:

You want to develop the skill ability of being able to execute a forehand stroke and place the ball in a specific area of your opponent's court during a tennis match.

INSTRUCTIONAL CUES:

1. Body position
 - a. The left side of the body is pointed toward the net.
 - b. The left foot is ahead of the right.
2. Backswing
 - a. Shift your weight to the back foot.
 - b. Extend the arm and swing the racket back at hip level to a point opposite the right hip.
3. Forward swing
 - a. Step forward and shift your weight to the left foot.
 - b. Keep the arm extended.
 - c. Keep your eyes on the ball.
 - d. Contact the ball.
 - e. Follow through with your racket.

<u>SKILLS</u>	<u>REPETITIONS</u>	<u>DATE COMPLETED</u>
1. Try each tennis grip by releasing and regripping the racket.	4	_____
2. Face the net and try the forehand stroke and foot pivot.	5	_____
3. Combine the pivot with the forehand backswing.	5	_____
4. Combine the foot pivot, backswing, forward swing, follow-through and recovery.	10	_____
5. Drop a ball and hit it against a wall 15 feet away with a forehand stroke.	25	_____
6. Repeat No. 5 only hit the wall above a line 3 feet from the floor.	20	_____
7. Repeat No. 5 only hit the ball into a 5' x 5' square 3 feet from the floor.	20	_____
8. Repeat No. 7 only hit the ball into a 4' x 4' square.	20	_____
9. Repeat No. 5 with consecutive forehand strokes.	6	_____
10. Repeat No. 6 with consecutive forehand strokes.	5	_____

<u>SKILLS</u>	<u>REPETITIONS</u>	<u>DATE COMPLETED</u>
11. Repeat No. 7 with consecutive forehand strokes.	5	_____
12. Repeat No. 8 with consecutive forehand strokes.	5	_____
<u>PARTNER SKILLS</u>		
13. From various positions in your back court, drop a ball and place it in your opponent's back court with a forehand stroke.	20	_____
14. Repeat No. 13 into the right half of your opponent's back court.	20	_____
15. Repeat No. 13 into the left half of your opponent's back court.	20	_____
16. Consecutive forehand rally with a partner.	8	_____

PART II

SKILLS: BACKHAND STROKE AND GRIP

STUDENT INFORMATION:

The backhand stroke is a more difficult skill than the forehand stroke. It is used for playing balls on the left side of the body. The mechanics of this stroke are the same as the forehand except in reverse. You can not be a complete tennis player unless you master this stroke.

PURPOSE:

To develop a stroke for returning balls which hit the court on the side away from the arm holding the racket and placing them in a specific area of your opponent's court during a tennis match.

INSTRUCTIONAL CUES:

1. Body position
 - a. The right side of the body is pointed toward the net.
 - b. The right foot is ahead of the left.
2. Backswing
 - a. The elbow is slightly bent.
 - b. Shift the weight to the back foot.
 - c. Carry the racket opposite the left hip.

3. Forward swing

- a. Shift the weight to the forward foot.
- b. Keep the arm extended.
- c. Contact the ball in front of the forward foot.

<u>SKILLS</u>	<u>REPETITIONS</u>	<u>DATE COMPLETED</u>
1. Hold the racket in a forehand grip. Swing the racket and change to a backhand grip.	10	_____
2. Face the net and use the foot pivot and grip change for the backhand stroke.	5	_____
3. Repeat skill No. 2 and add the backswing.	5	_____
4. Repeat skill No. 3 and add the forward swing, follow-through and recovery.	10	_____
5. Drop a ball and hit it against a wall 15 feet away with a backhand stroke.	25	_____
6. Repeat No. 5 only hit the wall above a line 3 feet from the floor.	20	_____
7. Repeat No. 5 only hit the ball into a 5' x 5' square 3 feet from the floor.	20	_____
8. Repeat No. 7 only hit the ball into a 4' x 4' square.	20	_____
9. Repeat No. 5 with consecutive backhand strokes.	20	_____

<u>SKILLS</u>	<u>REPETITIONS</u>	<u>DATE COMPLETED</u>
10. Repeat No. 6 with consecutive backhand strokes.	6	_____
11. Repeat No. 7 with consecutive backhand strokes.	5	_____
12. Repeat No. 8 with consecutive backhand strokes.	4	_____
 <u>PARTNER SKILLS</u>		
13. From various positions in your back court, drop a ball and place it in your opponent's back court with a backhand stroke.	20	_____
14. Repeat No. 13 into the left half of your opponent's back court.	20	_____
15. Repeat No. 13 into the right half of your opponent's back court.	20	_____
16. Consecutive backhand rally with a partner.	6	_____

PART IV

SKILL: THE SERVE

STUDENT INFORMATION

Serving is a very important part of your tennis game. In many cases, a good service will win the match for you. It can be a method of attacking your opponent's weaknesses.

The ball toss and racket arm movement require coordination that can only be achieved through practice. After individual practice, have a partner evaluate your form.

PURPOSE:

To develop the skill ability for placing a hard serve in your opponent's service court during a tennis match.

INSTRUCTIONAL CUES:

1. Ball Toss
 - a. Toss the ball with little or no spin.
 - b. The ball is tossed slightly higher than the height of the extended arm and racket.
2. Backswing
 - a. Start the arc in front of the body.
 - b. Rotate the trunk and shoulders away from the net.
 - c. Shift the weight to the right foot.

3. Forward Swing
 - a. As the ball starts down, shift the weight forward.
 - b. At the point of impact, the racket should be at its highest point.
 - c. For a flat serve the ball is hit "on center."
 - d. For a slice serve the ball is hit on the right side.
4. Follow Through
 - a. Recover your balance by stepping forward with the right foot.
 - b. The racket should continue its swing across the left side of the body.

<u>SKILLS</u>	<u>REPETITIONS</u>	<u>DATE COMPLETED</u>
1. Toss the ball up for the serve.	15	_____
2. Toss the ball up, draw back the racket and extend the arm. Do not hit the ball.	10	_____
3. Repeat No. 2, contact the ball.	10	_____

<u>PARTNER SKILLS</u>	<u>REPETITIONS</u>	<u>EVALUATION</u>	<u>DATE COMPLETED</u>
4. Repeat No. 2	5		_____

Partner check:

- a. Ball tossed slightly higher than the extended arm.

P F G

<u>PARTNER SKILLS</u>	<u>REPETITIONS</u>	<u>EVALUATION</u>	<u>DATE COMPLETED</u>
b. Little or no spin on the ball.		P F G	
5. Repeat No. 3	5		_____
Partner check:			
a. Weight shift to back foot on backswing.		P F G	
b. Trunk and shoulders rotated away from the net.		P F G	
c. Weight shifted forward on forward swing.		P F G	
d. Arm and racket fully extended at ball impact.		P F G	
e. Proper ball height.		P F G	
f. Step forward on follow-through.		P F G	
g. Foot fault.		P F G	
6. Good flat serves into the left service court.	20		_____
7. Good flat serves into the right service court.	20		_____

<u>PARTNER SKILLS</u>	<u>REPETITIONS</u>	<u>EVALUATION</u>	<u>DATE COMPLETED</u>
8. Good slice serves into the left service court.	20		_____
9. Good slice serves into the right service court.	20		_____

APPENDIX D

**DESCRIPTION OF BROER-MILLER FOREHAND-BACKHAND DRIVE
TEST AND HEWITT TENNIS ACHIEVEMENT TEST
SPEED OF SERVICE**

DESCRIPTION OF BROER-MILLER
FOREHAND-BACKHAND
DRIVE TEST

Description of Test

The test was designed to measure students' ability to place forehand and backhand drives into the backcourt area. It consisted of hitting a given number of balls so that they would pass between the top of the net and a restraining rope placed above the net, and of attempting to place these balls into the back 9 feet of the court. The ball was put into play by the student bouncing the ball to himself/herself.

A. Equipment

1. One regulation court.
2. One regulation net with a one-quarter inch rope stretched 4 feet above the top of the net. A 7' x 2" x 2" wood pole is installed at each net plate with which to string the rope.
3. One racket and 15-20 balls in good condition.
4. Score sheets for each player and pencils (see Appendix B).
5. Special court markings (see Figure 1, Appendix B).
 - a. Two chalk lines drawn across the court 10 feet inside the service line and 9 feet outside the service line and parallel to it.

- b. Two chalk lines drawn across the court 5 feet and 10 feet, respectively, outside the baseline and parallel to it.
- c. Chalked numbers in the center of each area to indicate its scoring value.

B. Test

1. The player taking the test stands behind the baseline, bounces the balls to himself/herself, hits the balls and attempts to place them in the back 9 feet of the opposite court.
2. Each player is allowed fourteen trials on the forehand and fourteen trials on the backhand.
3. In order to score the values as shown in Figure 1, balls must go between the top of the net and the rope and land in the designated area or on lines bounding the area (balls landing on a line receive the highest score for that area).
4. Balls which go over the top score one-half the value of that area in which they land.
5. If the player misses the ball in attempting to strike it, it is considered a trial.
6. Net balls are taken over.

C. Scoring

1. The number of each trial is marked on the score card diagram in the same relative position as the ball landed on the court.

2. Each ball hit is scored 2-4-6-8-6-4-2, depending upon the area in which it lands. Note: Each ball going over the rope is scored one-half the value of the area in which it lands (this may be indicated by circling the ball number on the scoring diagram).
3. The total score equals the sum of fourteen balls on the forehand and fourteen balls on the backhand.

Source: Marion Broer and Donna Miller, "Achievement Tests for Beginning and Intermediate Tennis," Research Quarterly, XXI (October, 1950), 307-313.

DESCRIPTION OF HEWITT TENNIS ACHIEVEMENT TEST
SPEED OF SERVICE

Description of Test

The speed of service test of the Hewitt Tennis Achievement Test is measured by the distance the ball travels on the second bounce. It consists of the subject serving ten good service placements which travel over the regulation tennis net and under a seven-foot restraining rope and strike the proper service court.

A. Equipment

1. One regulation tennis court.
2. One regulation tennis net with a one-quarter inch rope stretched four feet above the net. A 7' x 2" x 2" wood pole is installed at each net plate and the rope is strung between the poles.
3. One tennis racket and three dozen new heavy duty tennis balls.
4. Score sheets and pencils (see Appendix B).
5. Special court markings (see Figure 2, Appendix B).
 - a. Four chalk lines are drawn across the court at the following designated areas:
 1. A chalk line is drawn along the backcourt line and extending into the double lanes on both sides.
 2. A chalk line is drawn along the baseline.

3. A duplicating chalk line is drawn ten feet behind and parallel to the baseline.
4. A duplicating chalk line is drawn twenty feet behind and parallel to the baseline.
5. Chalked numbers are placed in the center of each area to indicate its scoring value.

B. Test

1. A 10-minute warm-up period is provided each student on another court.
2. The subject begins the service in a position behind the right center of the baseline.
3. The subject completes 10 good serves over the net and under the rope and into the proper service court. A ball which hits the rope or the net should be served over and not counted as a good serve.

C. Scoring

1. For each of the 10 good service placements, score on the score card the distance the ball travels on the second bounce. Indicate this by recording the value of the zone area in which the second bounce hit.
The value of the zone area is as follows:
Zone 1: Backcourt area to baseline--score one point
Zone 2: Area ten feet beyond the baseline--score two points

Zone 3: Area ten to twenty feet beyond the
baseline--score three points

Zone 4: Area 20 feet beyond the baseline or the
fence in most instances--score four points.

Source: Jack Hewitt, "Hewitt's Tennis Achievement Tests,"
Research Quarterly, XXXVII (May, 1966), 231-240.

APPENDIX E

**CAPSULE DESCRIPTION OF CATTELL'S SIXTEEN
PRIMARY PERSONALITY FACTORS--16PF**

CAPSULE DESCRIPTION OF THE SIXTEEN PRIMARY PERSONALITY FACTORS

Low Score Direction

High Score Direction

FACTOR A

**RESERVED, Detached, Critical, Cool
(Sizothymia)**

vs.

**OUTGOING, Warmhearted, Easy-going,
Participating
(Affectothymia)**

The person who scores low (sten of 1 to 3) on Factor A tends to be stiff, cool, skeptical, and aloof. He likes things rather than people, working alone, and avoiding compromises of viewpoints. He is likely to be precise and "rigid" in his way of doing things and in personal standards, and in many occupations these are desirable traits. He may tend, at times, to be critical, obstructive, or hard.

The person who scores high (sten of 8 to 10) on Factor A tends to be good-natured, easy-going, emotionally expressive (hence, naturally Affectothymia), ready to cooperate, attentive to people, soft-hearted, kindly, adaptable. He likes occupations dealing with people and socially impressive situations. He readily forms active groups. He is generous in personal relations, less afraid of criticism, better able to remember names of people.

FACTOR B

**LESS INTELLIGENT, Concrete-thinking
(Lower scholastic mental capacity)**

vs.

**MORE INTELLIGENT, Abstract-thinking, bright
(Higher scholastic mental capacity)**

The person scoring low on Factor B tends to be slow to learn and grasp, dull, given to concrete and literal interpretation. His dullness may be simply a reflection of low intelligence, or it may represent poor functioning to psychopathology.

The person who scores high on Factor B tends to be quick to grasp ideas, a fast learner, intelligent. There is some correlation with level of culture, and some with alertness. High scores contra-indicate deterioration of mental functions in pathological conditions.

FACTOR C

**AFFECTED BY FEELINGS, Emotionally Less Stable,
Easily Upset
(Lower ego strength)**

The person who scores low on Factor C tends to be low in frustration tolerance for unsatisfactory conditions changeable and plastic, evading necessary reality demands, neurotically fatigued, fretful, easily emotional and annoyed, active in dissatisfaction, having neurotic symptoms (phobias, sleep disturbances, psychosomatic complaints, etc.). Low Factor C score is common to almost all forms of neurotic and some psychotic disorders.

**HUMBLE, Mild, Accommodating, Conforming
(Submissiveness)**

The person who scores low on Factor E tends to give way to others, to be docile, and to conform. He is often dependent, confessing, anxious for obsessional correctness. This passivity is part of many neurotic syndromes.

vs.

**EMOTIONALLY STABLE, Faces Reality, Calm,
Mature
(Higher ego strength)**

The person who scores high on Factor C tends to be motionally mature, stable, realistic about life, unruffled, possessing ego strength, better able to maintain solid group morale. Sometimes he may be a person making a resigned adjustment* to unsolved emotional problems.

*Shrewd clinical observers have pointed out that a good C level sometimes enables a person to achieve effective adjustment despite an underlying psychotic potential.

FACTOR E

vs.

**ASSERTIVE, Independent, Aggressive,
Competitive, Stubborn
(Dominance)**

The person who scores high on Factor E is assertive, self-assured, and independent-minded. He tends to be austere, a law to himself, hostile or extrapunitive, authoritarian (managing others), and disregards authority.

FACTOR F

SOBER, Prudent, Serious, Taciturn
(Desurgency)

vs. HAPPY-GO-LUCKY, Impulsively Lively,
Enthusiastic
(Surgency)

The person who scores low on Factor F tends to be restrained, reticent, introspective. He is sometimes dour, pessimistic, unduly deliberate, and considered smug and primly correct by observers. He tends to be a sober, dependable person.

The person who scores high on this trait tends to be cheerful, active, talkative, frank, expressive, effervescent, carefree. He is frequently chosen as an elected leader. He may be impulsive and mercurial.

FACTOR G

EXPEDIENT, Evades Rules, Feels Few
(Weaker superego strength)

vs. CONSCIENTIOUS, Persevering, Staid, Rule-bound
(Stronger superego strength)

The person who scores low on Factor G tends to be unsteady in purpose. He is often casual and lacking in effort for group undertakings and cultural demands. His freedom from group influence may lead to anti-social acts, but at times makes him more effective, while his refusal to be bound by rules causes him to have less somatic upset from stress.

The person who scores high on Factor G tends to be exacting in character, dominated by sense of duty, persevering, responsible, planful, "fills the unforgiving minute." He is usually conscientious and moralistic, and he prefers hard-working people to witty companions. The inner "categorical imperative" of this essential superego (in the psychoanalytic sense) should be distinguished from the superficially similar "social ideal self" of Q_3^+ .

FACTOR H

SHY, Restrained, Diffident, Timid
(Threctia)

The person who scores low on this trait tends to be shy, withdrawing, cautious, retiring, a "wallflower." He usually has inferiority feelings. He tends to be slow and impeded in speech and in expressing himself, dislikes occupations with personal contacts, prefers one or two close friends to large groups, and is not given to keeping in contact with all that is going on around him.

vs. **VENTURESOME, Socially-bold, Uninhibited, Spontaneous**
(Parmia)

The person who scores high on Factor H is sociable, bold, ready to try new things, spontaneous, and abundant in emotional response. His "thick-skinnedness" enables him to face wear and tear in dealing with people and grueling emotional situations, without fatigue. However, he can be careless of detail, ignore danger signals, and consume much time talking. He tends to be "pushy" and actively interested in the opposite sex.

FACTOR I

TOUGH-MINDED, Self-reliant, Realistic, No-nonsense
(Harria)

The person who scores low on Factor I tends to be practical, realistic, masculine, independent, responsible, but skeptical of subjective, cultural elaborations. He tends to keep a group operating on a practical and realistic "no-nonsense" basis.

vs. **TENDER-MINDED, Dependent, Overprotected, Sensitive**
(Premsia)

The person who scores high on Factor I tends to be tender-minded, daydreaming, artistic, fastidious, feminine. He is sometimes demanding of attention and help, impatient, dependent, impractical. He dislikes crude people and rough occupations. He tends to slow up group performance and to upset group morale by unrealistic fussiness.

FACTOR L

**TRUSTING, Adaptable, Free of Jealousy, Easy
to Get on With
(Alaxia)**

The person who scores low on Factor L tends to be free of jealous tendencies, adaptable, cheerful, uncompetitive, concerned about other people, a good team worker.

vs. **SUSPICIOUS, Self-opinionated, Hard to Fool
(Protension)**

The person who scores high on Factor L tends to be mistrusting and doubtful. He is often involved in his own ego, is self-opinionated, and interested in internal, mental life. He is usually deliberate in his actions, unconcerned about other people, a poor team member.

FACTOR M

**PRACTICAL, Careful, Conventional, Regulated
by External Realities, Proper
(Praxernia)**

The person who scores low on Factor M tends to be anxious to do the right things, attentive to practical matters, and subject to the dictation of what is obviously possible. He is concerned over detail, able to keep his head in emergencies, but sometimes unimaginative.

vs. **IMAGINATIVE, Wrapped up in Inner Urgencies,
Careless of Practical Matters,
Absent-minded
(Autia)**

The person who scores high on Factor M tends to be unconventional, unconcerned over everyday matters, Bohemian, self-motivated, imaginatively creative, concerned with "essentials," and oblivious of particular people and physical realities. His inner-directed interests sometimes lead to unrealistic situations accompanied by expressive outbursts. His individuality tends to cause him to be rejected in group activities.

FACTOR N

**FORTHRIGHT, Natural Artless, Sentimental
(Artlessness)**

The person who scores low on Factor N tends to be unsophisticated, sentimental, and simple. He is sometimes crude and awkward, but easily pleased and content with what comes, and is natural and spontaneous.

vs. **SHREWD, Calculating, Worldly, Penetrating
(Shrewdness)**

The person who scores high on Factor N tends to be polished, experienced, worldly, shrewd. He is often hardheaded and analytical. He has an intellectual, unsentimental approach to situations, an approach akin to cynicism.

FACTOR O

**PLACID, Self-assured, Confident, Serene
(Untroubled adequacy)**

The person who scores low on Factor O tends to be placid, with unshakable nerve. He has a mature, unanxious confidence in himself and his capacity to deal with things. He is resilient and secure, but to the point of being insensitive of when a group is not going along with him, so that he may evoke antipathies and distrust.

vs. **APPREHENSIVE, Worrying, Depressive, Troubled
(Guilt proneness)**

The person who scores high on Factor O tends to be depressed, moody, a worrier, full of foreboding, and brooding. He has a child-like tendency to anxiety in difficulties. He does not feel accepted in groups or free to participate. High Factor O score is very common in clinical groups of all types.

FACTOR Q₁

CONSERVATIVE, Respecting Established Ideas,
Tolerant of Traditional
Difficulties
(Conservatism)

The person who scores low on Factor Q₁ is confident in what he has been taught to believe, and accepts the "tried and true," despite inconsistencies, when something else might be better. He is cautious and compromising in regard to new ideas. Thus, he tends to oppose and postpone change, is inclined to go along with tradition, is more conservative in religion and politics, and tends not to be interested in analytical "intellectual" thought.

vs.

EXPERIMENTING, Critical, Liberal, Analytical,
Free-thinking
(Radicalism)

The person who scores high on Factor Q₁ tends to be interested in intellectual matters and has doubts on fundamental issues. He is skeptical and inquiring regarding ideas, either old or new. He tends to be more well informed, less inclined to moralize, more inclined to experiment in life generally, and more tolerant of inconvenience and change.

FACTOR Q₂

GROUP-DEPENDENT, A "Joiner" and Sound
Follower
(Group adherence)

The person who scores low on Factor Q₂ prefers to work and make decisions with other people, likes and depends on social approval and admiration. He tends to go along with the group and may be lacking in individual resolution. He is not necessarily gregarious by choice; rather, he needs group support.

vs.

SELF-SUFFICIENT, Prefers Own Decisions,
Resourceful
(Self-sufficiency)

The person who scores high on Factor Q₂ is temperamentally independent, accustomed to going his own way, making decisions and taking action on his own. He discounts public opinion, but is not necessarily dominant in his relations with others (see Factor E). He does not dislike people, but simply does not need their agreement or support.

FACTOR Q₃

UNDISCIPLINED SELF-CONFLICT, Careless of Protocol, Follows Own Urges (Low integration)

vs.

CONTROLLED, Socially precise, Following Self-image (High self-concept control)

The person who scores low on Factor Q₃ will not be bothered with will control and regard for social demands. He is not overly considerate, careful, or painstaking. He may feel maladjusted, and many maladjustments (especially the affective, but not the paranoid) show Q₃⁻.

The person who scores high on Factor Q₃ tends to have strong control of his emotions and general behavior, is inclined to be socially aware and careful, and evidences what is commonly termed "self-respect" and regard for social reputation. He sometimes tends, however, to be obstinate. Effective leaders, and some paranoids, are high on Q₃.

FACTOR Q₄

RELAXED, Tranquil, Torpid, Unfrustrated (Low ergic tension)

vs.

TENSE, Frustrated, Driven, Overwrought (High ergic tension)

The person who scores low on Factor Q₄ tends to be sedate, relaxed, composed, and satisfied (not frustrated). In some situations, his oversatisfaction can lead to laziness and low performance, in the sense that low motivation produces little trial and error. Conversely, high tension level may disrupt school and work performance.

The person who scores high on Factor Q₄ tends to be tense, excitable, restless, fretful, impatient. He is often fatigued, but unable to remain inactive. In groups he takes a poor view of the degree of unity, orderliness, and leadership. His frustration represents an excess of stimulated, but undischarged, drive.

Source: Institute for Personality and Ability Testing, Manual for the 16PF (Champaign, Illinois: Institute for Personality and Ability Testing, 1972), pp. 17-28.

APPENDIX F

**THE PRIMARY SOURCE TRAITS COVERED
BY THE 16PF TEST**

THE PRIMARY SOURCE TRAITS COVERED BY THE 16PF TEST

Factor	Low Sten Score Description (1-3)	High Sten Score Description (8-10)
A	<u>Reserved</u> , detached, critical, aloof, stiff Sizothymia	<u>Outgoing</u> , warmhearted, easy-going, participating Affectothymia
B	<u>Dull</u> Low intelligence	<u>Bright</u> High intelligence
C	<u>Affected by feelings</u> , emotionally less stable, easily upset, changeable Lower ego strength	<u>Emotionally stable</u> , mature, faces reality, calm Higher ego strength
E	<u>Humble</u> , mild, easily led, docile, accommodating Submissiveness	<u>Assertive</u> , aggressive, competitive, stubborn Dominance
F	<u>Sober</u> , taciturn, serious Desurgency	<u>Happy-go-lucky</u> , enthusiastic Surgency
G	<u>Expedient</u> , disregards rules Weaker superego strength	<u>Conscientious</u> , persistent, moralistic, staid Stronger superego strength
H	<u>Shy</u> , timid, threat-sensitive Threctia	<u>Venturesome</u> , uninhibited, socially bold Parmia
I	<u>Tough-minded</u> , self-reliant, realistic Harria	<u>Tender-minded</u> , sensitive, clinging, overprotected Premsia
L	<u>Trusting</u> , accepting conditions Alaxia	<u>Suspicious</u> , hard to fool Protension

Factor	Low Sten Score Description (1-3)	High Sten Score Description (8-10)
M	<u>Practical</u> , "down-to-earth" concerns Praxernia	<u>Imaginative</u> , Bohemian, absent-minded Autia
N	<u>Forthright</u> , unpretentious, genuine but socially clumsy Artlessness	<u>Astute</u> , polished, socially aware Shrewdness
O	<u>Self-assured</u> , placid, secure, complacent, serene Untroubled adequacy	<u>Apprehensive</u> , self-reproaching, insecure, worrying, troubled Guilt proneness
Q ₁	<u>Conservative</u> , respecting traditional ideas Conservatism of temperament	<u>Experimenting</u> , liberal, free-thinking Radicalism
Q ₂	<u>Group dependent</u> , a "joiner" and sound follower Group adherence	<u>Self-sufficient</u> , resourceful, prefers own decisions Self-sufficiency
Q ₃	<u>Undisciplined self-conflict</u> , lax, follows own urges, careless of social rules Low self-sentiment integration	<u>Controlled</u> , exacting will poers, socially precise, compulsive, following self-image High strength of self-sentiment
Q ₄	<u>Relaxed</u> , tranquil, torpid, unfrustrated, composed Low ergic tension	<u>Tense</u> , frustrated, driven, overwrought High ergic tension

Source: Institute for Personality and Ability Testing, Manual for the 16PF (Champaign, Illinois: Institute for Personality and Ability Testing, 1972), p. 6.

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