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PREDICTIVE TESTING FOR ENTRANCE IN VOCATIONAL-TECHNICAL SCHOOLS, PHASE ONE.

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THE FLANAGAN APTITUDE CLASSIFICATION TEST, THE GORDON OCCUPATIONAL CHECK LIST, THE STANFORD ACHIEVEMENT TEST, THE PRIMARY MENTAL ABILITIES TEST, AND THE GORDON SURVEY OF INTERPERSONAL VALUES WERE ADMINISTERED IN A PILOT STUDY UNDERTAKEN AS PART OF A LARGER STUDY DESIGNED TO DEFINE MORE EFFECTIVE INSTRUMENTS FOR IDENTIFYING VOCATIONALLY TALENTED STUDENTS. COMPREHENSIVE ACHIEVEMENT TESTS IN TRADE MACHINE SHOP AND TRADE ELECTRICAL SHOP WERE DEVELOPED BY CURRICULUM SPECIALISTS TO BE USED AS CRITERIA MEASURES AND WERE ADMINISTERED WITH THE PREDICTIVE TEST BATTERY TO ABOUT 200 GRADE 12 STUDENTS ENROLLED IN TRADE PROGRAMS AT SIX SELECTED VOCATIONAL-TECHNICAL SCHOOLS. AN ANALYSIS OF SCHOOL RECORDS AND TEACHER MARKS INDICATED THAT A MAJORITY OF STUDENT WHO SCORED ABOVE THE MEAN ON THE ACHIEVEMENT INSTRUMENT WERE SCHOLASTICALLY IN THE UPPER ONE-THIRD OF THEIR VOCATIONAL GROUP AND HAD INTELLIGENCE QUOTIENTS OF ABOVE 100. USE OF THE SURVEY OF INTERPERSONAL VALUES AND THE OCCUPATIONAL CHECK LIST SHOWED LITTLE DIFFERENCE BETWEEN THE RESPONSES OF SUCCESSFUL AND UNSUCCESSFUL STUDENTS. THE CORRELATION OF SCORES ON THE PREDICTIVE TEST BATTERY WITH THOSE ON THE ACHIEVEMENT INSTRUMENTS INDICATED THAT ALL OF THE TESTS HAD SOME DEGREE OF PREDICTIVE VALUE. THE PREDICTIVE TEST BATTERY WAS REDUCED AND ADMINISTERED TO ALL STUDENTS ENTERING VOCATIONAL-TECHNICAL SCHOOLS IN THE FALL OF 1966. FOLLOWING SUGGESTED RECOMMENDATIONS, THE SCORES WILL BE USED FOR FUTURE COMPARISONS AND REFINEMENTS OF THE TEST BATTERY. (HC)

Predictive Testing for Entrance in Vocational-Technical Schools

Phase One

A study of the predictive value of a pre-selected battery of standardized tests as a tool for the selection of entering students in certain trade programs offered in the vocational-technical schools of the State of Connecticut

November 1966

New York University
Center for Field Research and School Services

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November 1966

John G. Miller, Director
New York University Study Team

New York University
Center for Field Research and School Services

This research reported herein was performed pursuant to a subcontract with the New York State Education Department. Subcontractors undertaking such projects under state sponship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official State Department of Education position or policy.

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Center for Field Research and School Services
OFFICE OF OFF-CAMPUS COURSES

November 4, 1966

Dr. Herbert Righthand, Chief
Bureau of Vocational Services
State Office Building
Hartford, Connecticut

Dear Dr. Righthand:

In fulfillment of an agreement dated March 30, 1966, between the New York State Education Department and the Center for Field Research and School Services, I am pleased to submit 500 copies of a report entitled, Predictive Testing For Entrance In Vocational-Technical Schools. This represents the culmination of Phase I of New York State contract No. C19724 titled "The Selection of Students For Entrance Into Trade Programs In Public Secondary Vocational Schools."

The Connecticut State Department of Education and New York State Education Department deserve commendation for establishing a cooperative relationship which made it possible to complete this significant study of student aptitudes in the complex area of vocational and technical education. Undoubtedly, the study findings will prove useful to many educational agencies and communities throughout the United States. The professional staffs involved were most cooperative in providing data, offering cousel, and facilitating the study in general. The spirit of good will which prevailed during the study augurs well for an effective follow through on its implications.

Obviously, all recommendations in this report are not equally viable. Final decisions, moreover, are always the prerogative of constituted authority rather than of a consulting team, regardless of the latter's expertise. This report will serve its purpose best if it is studied and discussed by all who are concerned with vocational and technical education in Connecticut and elsewhere. To this end, the Study Director is prepared to assist with the presentation and interpretation of the report.

Dr. Herbert Righthand, Chief November 4, 1966

As you know, a contract is being prepared for Phase II of "The Selection of Students for Entrance Into Trade Programs In Public Secondary Vocational Schools." New York University and its Center for Field Research and School Services look forward to a continued association with the State of Connecticut in this important research endeavor.

Respectfully submitted,

Lou Kleinman

Lou Kleinman, Director
Center for Field Research
and School Services

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cc: Dean Daniel E. Griffiths
Professor John G. Miller
Dr. Alan G. Robertson

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INTRODUCTION

One of the most important tasks in the administration of any program of vocational-technical education is that of pupil selection. Since teachers and administrators of all secondary school curriculum areas are interested in the pupil with high achievement potential and better-than-average intelligence scores, pupils selected for the vocational-technical program are often those who are not able to meet the highest academic standards so necessary for success in secondary school programs which are designed specifically to prepare students for entrance into college. Often this is the reason the vocational-technical programs do not generally attract the academically talented. Because of the very nature of the various course offerings in a vocational-technical school, it is generally assumed that pupils elect to apply for entrance to these programs because of their interest in working with tools, equipment, and machinery rather than with books and abstract ideas.

Most of the better secondary vocational-technical schools in this country rely on some form of predictive testing as a phase of the pupil-selection process. Probably there are no two school systems which use exactly the same techniques of selection. Many pupil-selecting procedures rely on some use of achievement tests; intelligence tests; aptitude tests; occupational inventories; and attitude surveys. Up to the present time there has been little investigation concerning the predictive value of such standardized tests for specific occupational areas available to pupils who are making application for entrance into secondary vocational-technical schools.

The major concern in determining the predictive value of a battery of tests is the individual pupil. It is the choice of his occupational career that is at stake. If the time he spends in the occupational program is not used to the best advantage because he lacks potential for entrance into the occupation for which he is training, his entire career may be jeopardized. A secondary concern in examining the predictive value of certain standardized tests is the consideration of the high cost of education. If selection techniques can be improved we should have fewer "drop-outs" and a higher percentage of placement among graduates in the occupation for which the training was designed. The fact that most vocational-technical programs are more expensive to operate than traditional academic programs makes the economic aspect of this Study especially important.

Modern Technology and Unemployed Youth

The public schools of the United States now enroll nearly all of the children of all of the people, an enviable accomplishment which has been achieved during the past century. Among other things, parents expect the schools to provide an education; the development of habits of safe, healthful living; a respect for individual dignity and the practice of friendly cooperation as well as an introduction to the appreciation of and the practice of the arts. Parents also expect their children to learn how to earn a living, preferably a better living than they have been able to provide for themselves.

Nationwide predictions indicate that of every ten pupils now enrolled in elementary grades, three will probably not graduate from high school.[1] How will this thirty percent of our youth fill their place in the occupational world without a high school diploma? Of the seven boys and girls who finish high school during the present decade, three will not go on to college. Will these three have the kind of education for which they are best suited? Of the four remaining students who go on to college, only two will complete requirements for the baccalaureate degree. Thus eight out of ten youngsters who are now in elementary school will most likely have a need for some kind of occupational education. Twenty-six million of these youngsters are expected to enter the labor force during the years 1960-1970.[2] Will these young people be adequately prepared for the world of work? Will their interests, skills, and knowledge meet the requirements of our changing technological society?

A recent report made by the American Council on Education[3] indicates that the country is confronted by the paradox of between four and five million persons unemployed, at the same time that there are job openings for some four million skilled workers. Much of the problem rests with the fact that in secondary schools there has been a major emphasis on preparing young people for college entrance. Too little effort has been placed in the improvement of educational opportunities for the vast majority of students who will not go to college. The report of the American Council further indicates that in order to meet the minimum goals of preparing the needed one-hundred-thousand new technicians for the fields of science and engineering alone, the educational system will have to triple its present efforts. One aspect of this challenge involves the development of more efficient vocational-technical schools on the secondary level. One of the first steps in improving efficiency involves improved techniques in the selection of students who can most successfully benefit from specialized occupational instruction.

The Drop-Out Problem

The President's Panel of Consultants on Vocational Education reported that during the past decade, of every ten youngsters enrolled in grade schools, three will not finish high school. This indicates a national drop-out rate of thirty percent.[4] Many educators have concluded that an occupational program on the secondary level will have more meaning to this segment of the pupil population and therefore many of these potential "drop-outs" are being guided into vocational-technical programs. Since such programs have traditionally attracted a large percent of pupils who may leave high school before completion, leaders in education and others have expressed interest in the identification of the best selection instruments for predicting the success of such pupils. With a battery of reliable

1. Education for a Changing World of Work. Summary Report of the Panel of Consultants on Vocational Education requested by the President of the United States, Washington, D. C.: Superintendent of Documents, 1963.
2. Ibid.
3. Venn, Grant, Man Education and Work. Washington, D. C.: American Council on Education, 1964.
4. Education for a Changing World of Work. Loc. Cit.

selection instruments the counselor should be able to more accurately predict success of pupils in certain occupational programs and thereby reduce the number of pupils who eventually leave school before completing training programs. Improvement in the effective holding power of secondary vocational-technical schools will probably result in a more economical program, a more meaningful program from the point of view of the pupils and a more efficient program with reduced pupil attrition.

The Vocational Education Act of 1963

The Vocational Education Act of 1963 was passed because of the accumulating evidence that earlier Federal programs of assistance to vocational education beginning with the Smith-Hughes Act of 1917 and augmented and supplemented over the years by other acts of Congress - was not broad enough, or flexible enough, or rich enough to meet the needs of today much less the needs of tomorrow.

The Act is comprehensive: it excludes no group, no occupation, except those generally considered professional and others requiring a baccalaureate or higher degree. It is concerned with workers of all ages at all levels for all fields; about persons in sparsely-settled areas as well as the urban areas; about delinquent young people as well as the most industrious; about the employed as well as the unemployed and the underemployed. In its provisions for making vocational education available at all persons, the Act is not only idealistic but realistic; it requires each state and each community to plan its vocational education programs with an eye always on the changes taking place in the economy and in the world of work.

The Act is also concerned with the quality of education - with wise choices by the pupils with the training of teachers, with the supply of materials and equipment, with research of problems and a search for solutions. The Act provides for assistance which should help bring excellence into all programs or vocational education.

The Act provides for ten percent of each year's over-all appropriation for a discretionary fund in the hands of the United State Commissioner of Education for the support of special research and demonstration projects. It is the impetus of this part of the Act that has made it possible to pursue this important study.

The Study Defined

The original plans for this research project were first formulated in a meeting of staff members from the Bureau of Occupational Education Research of the State Education Department of the State of New York and the Department of Education, State of Connecticut. This meeting explored the development of a research proposal which was to be jointly sponsored by the State of Connecticut and the State of New York.

Objectives of the Study

The specific purpose of the Study is to define more effective instruments in the form of a battery of predictive tests to be used for the selection of entering students in trade programs offered in the vocational-technical schools of the State of Connecticut. The need for defining these selection instruments is to provide counselors with a more reliable tool for the identification of vocationally talented students who may be expected to prove successful in certain program areas common to vocational-technical schools. It will not be the purpose of this Study to establish cut-of scores after the predictive test battery has been identified.

The objectives of the Study are further defined to include high school programs in Trade Machine Shop and Trade Electrical Shop. These two areas of the school program were selected because of their similarity of program and size in terms of pupil population for norming purposes. The fact that there is a high degree of similarity between programs in these two trade areas as they are taught in New York and Connecticut, strengthened the decision to start with the definition of predictive tools which would specifically apply to these areas.

If reasonable success is proven through the techniques used in studying predictive testing in these two trade areas, a continuation of the Study to cover other occupational areas will be investigated at a later date.

Phase One

In order to conduct the research over a prolonged period of time, it was first necessary to identify the activities which would form a foundation for the over-all objectives. Phase One of the Study is primarily concerned with the initial collection of data which will be used at a later date. A major factor in the design of Phase One of the Study was the time limit placed upon this part of the Study by the policies of funding through the U. S. Office of Education. Phase One of the Study began March 1, 1966 and required completion on November 30, 1966. During this Phase, the Study Team conducted a Pilot Study in a limited number of schools and administered a battery of selected predictive tests to all entering students in the fourteen vocational-technical schools of the State of Connecticut.

Sponsoring Agency

This part of the Study was financed by the Office of Education, Washington, D. C. through the New York State Education Department via the Bureau of Occupational Education Research. This Study in pupil selection is part of a larger research project being conducted jointly by the State of New York and the State of Connecticut.

Vocational-Technical Education in Connecticut

The State program for vocational-technical education in Connecticut is organized in such a way that a Study of this kind can be conducted with reasonable expectancy of success. Connecticut's vocational schools are all regional secondary schools operated by the State Department of Education. The principal objectives of these schools are the development

of good citizenship, a reasonable degree of social competency, and the development of a marketable occupational skill. There are fourteen vocational-technical schools located throughout the State, each having similar programs in the curricula areas being covered by this Study. Trade Electricity is taught in each of the schools and is directed toward the fundamental training of an electrician. House wiring, repair and "trouble shooting" on motors, generators, wiring systems, switchboard installations, and the use of basic testing equipment for electronics constitute the three-year curriculum. Trade Machine Shop is also taught in all vocational-technical schools within the State. The machine shop course offers instruction in the operation of basic machine shop equipment including the production machines commonly found in modern industry. In addition to the development of manipulative skills, the curriculum includes instruction in blueprint reading, sketching, related sciences and mathematics, in addition to general education courses. Each of the fourteen vocational-technical schools is a regional school serving the community in which it is located and also the surrounding communities. Many schools have specialty courses not offered in every vocational school such as automobile body repair, aviation mechanics, baking, barbering, beauty culture, dental assistant, fashion design, food trades, occupational homemaking, industrial chemistry, industrial electronics, instrument making, practical nursing, painting and decorating, printing, plumbing and heating, screw machine operation, sheet metal, and tool and die making.

Organization of the Study

This Study has been conducted under a sub-contract by New York University's Center for Field Research and School Services which has agreed to conduct Phase One in conjunction with the State Department of Education, Bureau of Vocational Services, Hartford, Connecticut. In order to effectively conduct the proposed research, the Director of the Study first organized a committee structure for implementing the various activities of the Study Team.

Executive Committee

An Executive Committee was organized for the purpose of determining and approving procedures concerning policy in the implementation of the various aspects of the Study. This Executive Committee nominated persons who served as members of the Advisory Committee and a Planning-Action Committee. It was the duty of the Executive Committee to resolve all questions regarding major problems encountered during the Study. Four meetings of the Executive Committee were held in Hartford and a fifth meeting was held in Stamford during the period of the Study. Periodic progress reports were submitted to the Chairman of the Executive Committee by the Director of the Study. The names of persons who served on the Executive Committee appear in the appendix (pg. A-1).

Advisory Committee

The Advisory Committee assisted the members of the N. Y. U. Study Team in the implementation of the Study. This committee was

oriented to the purposes and plans for conducting the Study by a member of the Executive Committee during two of their regular monthly meetings. Members of this committee have been contacted individually for advice regarding test scheduling and for the collection of other necessary data. This committee was also helpful in reviewing the preliminary report of the Study. Serving on this committee were the directors of the fourteen vocational-technical schools throughout the State. A list of members appears in the appendix (pg. A-2).

Planning-Action Committee

The Planning-Action Committee included two teams of "Study Aids". One group was comprised of guidance counselors from each of the fourteen schools that participated in the Study. A second group was composed of curriculum specialists in the areas of Trade Machine Shop and Trade Electrical Shop. Representatives from the Central Office of the State Department of Education were also members of this committee in an advisory capacity. The Planning-Action Committee worked directly with the N. Y. U. Study Team in the collection of data; the administration of the predictive battery of tests; the construction of the achievement instruments; and the scoring of the achievement instruments. In cases where members of the Planning-Action Committee were asked to perform services beyond their normal duties during the school day, they were reimbursed for their services by the Director of the Study. A list of members of this committee and the service area which they represented appears in the appendix (pg. A-2 — A-3).

N. Y. U. Study Team

The N. Y. U. Study Team was composed of a Director of the Study and two consultants who had the major responsibility for conducting the Study. Names of members or this team appear in the appendix (pg. A-1).

The Pilot Study

A pilot program of testing, both predictive and achievement, was a major part of the first phase of the Study. This Pilot Study was conducted during the spring term 1966. The purpose of the Pilot Study was to try out testing procedures and to design and administer the achievement instrument in a limited number of schools.

The Executive Committee selected the pilot schools with several factors in mind. It was considered desirable to select schools with sufficient enrollments in twelfth grade Trade Machine Shop and twelfth grade Electrical Shop in order to test a total enrollment of one hundred students for each subject in order to provide a reasonable sample in each area. Schools were selected which had four-year programs consisting of pre-vocational shops in ninth grade and three-year trade classes. Because of the large ninth grade enrollment in Bullard-Havens Technical School in Bridgeport, this ninth grade group was used as the experimental group in the predictive tests in addition to the twelfth grade pupils in the trade areas covered by the Study.

Schools Used for Pilot Testing Program and Approximate Enrollment Figures

SCHOOL NAME	12th Grade Electricity	Enrollment Machine
Bullard-Havens Technical School	33	25
Warren F. Kaynor Technical School	17	26
Horace C. Wilcox Technical School	14	16
Windham Regional Technical School	16	16
Oliver Wolcott Technical School	16	18
J. M. Wright Technical School	13	15
Total	109	116

The total ninth grade enrollment for boys' trades in the Bullard-Havens Technical School was approximately two hundred.

The Achievement Criteria

During the spring of 1966, Mr. George Kleitz met with Planning-Action Committee members in two separate groups. One group of five curriculum specialists worked on the development of the achievement instrument for twelfth grade Trade Machine Shop and the second group of five curriculum specialists worked on the development of the achievement instrument for twelfth grade Trade Electrical Shop. Each group met at least five times in a location convenient to the majority of the members. A representative from the Central Office of the Department of Education met with each group.

Each of the achievement instruments was developed in two basic parts: a section on "technical competence" and a second section involving the performance of a series of skills in the shop. The technical aspect of the achievement instrument was designed to be administered to a class during a single three-hour session. Students could make use of standard handbooks, code books or other reference materials in answering questions. The instruments involved both technical knowledge and computations. These instruments were comprehensive, covering the entire three-year course of study.

The following is a summary of the various parts of each of the achievement instruments:

Twelfth Grade Trade Machine Shop

Part I

Section A included technical questions basic to machine shop practice. Students were instructed to answer all the questions in this section. Questions were of the objective and also long-answer type involving computation and technical knowledge. A perfect score on Section A totaled thirty credits.

Section B provided a selection of questions. Essay, computation and short-answer type questions were used and the student was asked to choose questions which could give him a maximum total of twenty credits.

Part II

This part of the instrument was a performance test making use of the shop equipment. It involved one job which included all of the basic operations on an engine lathe including an external and also an internal thread. This performance test also required some use of the drill press, the milling machine and the surface grinder. Ratings were made on a standard rating sheet based on:

Skill.	20 credits
Time.	10 credits
Quality	10 credits
Work habits	10 credits

The instructor's rating sheet suggested specific credit values of two, three and five credits for items listed under the above headings. A perfect score was indicated by a rating of fifty credits. Two instructors rated each performance job.

Twelfth Grade Trade Electrical Shop

Part I

Section A contained technical questions of the short-answer type. Students were instructed to answer all questions. Questions included both technical and computational information. A perfect score would total thirty credits.

Section B had a total of eight questions. The student was permitted to select four of the eight questions for a possible total score of twenty credits. This part of the test required more critical thinking both in technical content and also with respect to computation. A perfect score would be twenty credits.

Part II

The performance test included three separate wiring jobs. Job #1 involved a push-button switch, a three-phase motor control and a motor using EMT Conduit and flexible conduit. This job was rated with a

Fig. 1

Students Taking Part I
of the
Achievement Test

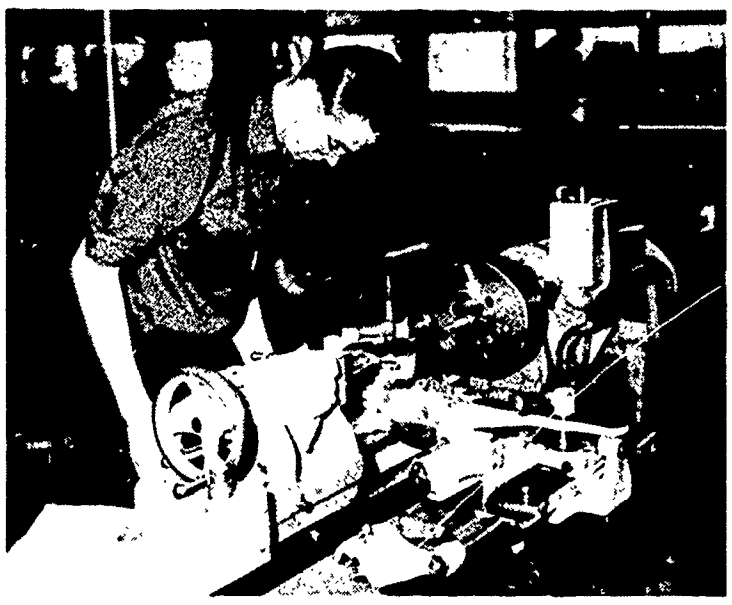

Fig. 2

Performance Testing
in
Trade Machine Shop

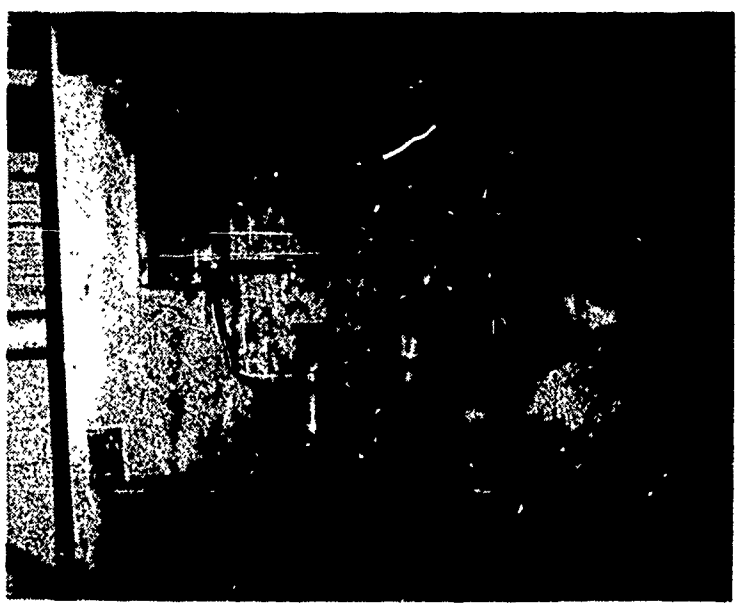

Fig. 3

Performance Testing
in
Trade Electrical Shop

score of fifty credits representing a perfect score. Job #2 included the wiring of a service entrance with an outside meter box and a sixty ampere main range and lighting panel distribution box. Fifty credits represented a perfect score. Job #3 was a wiring problem involving the control of two lights from three locations. Wiring was to be done using metal-clad cable and the installation was considered as "new work" type construction.

Each of the above jobs was rated as follows:

Skill	20 credits
Time	10 credits
Quality	10 credits
Work habits	10 credits

A rating sheet was provided for the instructors which subdivided the above rating areas into two, three and five units of credit. Two instructors rated each student.

Achievement instruments were edited by the members of the N. Y. U. Study Team and were published early in May. Teachers and counselors in the schools where tests were to be administered were oriented regarding suggested testing schedules and the materials which would be necessary to have on hand for the performance phase of the achievement test. The members of the Planning-Action Committee who designed the instruments were of the opinion that all schools would have the necessary stock and supplies for administering the performance part of the instrument.

Administering the Achievement Criteria

The printed tests, which were developed by the Curriculum Study Aids, were delivered in person to each of the schools participating in the Pilot Study. The Director of the Study met with the guidance counselor in each school and reviewed the testing procedures with him and the shop teachers who were directly involved. Testing started May 23rd and, in most schools, was completed by June 10th. The shop teachers administered both parts of the tests under the supervision of the guidance counselor. The six-hour performance part of the Trade Machine Shop and the Trade Electrical Shop Tests was administered to groups of three to six students at a time over a period of one week, depending upon the size of the class and the equipment available at a particular school. Two instructors scored each of the written tests using a uniform answer sheet prepared by curriculum specialists on the Planning-Action Committee. Two instructors scored each of the performance jobs in electrical wiring, using a uniform rating sheet, before the job was removed from the wiring booth. Specimens of the machine shop performance test were tagged by the student and scored by two instructors using a uniform rating sheet prepared by curriculum specialists. The Director of the Study observed the testing program while performance tests were being administered in one of the Pilot Schools.

All test papers and answer sheets were returned to the N. Y. U. Study Team at the conclusion of the testing period. Score sheets for the Performance Tests were signed by the two teachers who did the rating and the written tests were signed by the student and the two teachers who scored the papers. The Machine Shop Performance speciments were tagged and returned to the N. Y. U. Study Team. The Written and Performance Tests were both spot-checked for uniformity in scoring by the Study Team.

A summary sheet of the results of the Performance Tests was prepared for each school with tabulations for each sub-test by student's name. These tabulations were used by the Study Team in the analysis.

The Predictive Test Battery

The first selection of the test battery was made early in the original planning of the Study before the N. Y. U. Study Team had been organized. The initial planners of the Study wished to bring together a comprehensive battery which would reflect: aptitude; general achievement; mental abilities; attitudes; and occupational interest. The following battery of commercial tests was considered to be most desirable for the purpose of the Study:

The Flanagan Aptitude Classification Test (FACT)

The Gordon Occupational Check List

The Stanford Achievement Test

The Primary Mental Abilities Test

The Gordon Survey of Interpersonal Values

Test Administration

The predictive battery of tests was administered after the Easter Recess to all twelfth grade students in Trade Machine Shop and Trade Electrical Shop in each of the Pilot Schools. The battery of tests was also administered to the entire ninth grade class of boys in the Bullard-Havens Technical School in Bridgeport. The purpose of administering this battery to this ninth grade class was merely to collect data on this group of students which may prove useful to the Study Team in making comparisons when they arrive in the eleventh grade in 1968 and in the twelfth grade in 1969.

An effort was made by the Study Team to make an analysis of the administrative problems of test administration and to anticipate possible problems. The directions for test administration were analyzed and rewritten in terms of exact time limits and instructions to be read to examinees. The procedures used in reference to the changes made in instructions met with the approval of counselors and proctors and will be followed in the preparations for the future administration of standardized tests.

Scoring and Tabulation

The test forms and the answer sheets used were planned to provide for a minimum of administrative handling by the proctors in the schools where tests were given. Answer sheets were machine-scored for the three tests used. Pupil answers on the two check lists used were individually hand-scored at New York University.

The Stanford Achievement Test, Advanced Battery (Partial)
Grades 7 - 9
(Harcourt, Brace and World, Inc.)

This test included a test on paragraph meaning in which paragraphs are graduated in difficulty, a spelling test based on the 5000 words first used and a language test for the purpose of appraising language usage. The test also included a test on arithmetic computations, a test on arithmetic concepts, including terms, values, relationships, and a test on arithmetic application as applied to life experiences. (Machine scored)

Primary Mental Abilities Test
Grades 9 - 12
(Science Research Associates)

This test investigated the five factors of intelligence most critical in schoolwork. These include verbal meaning, number facility, reasoning, perceptual speed and special relationships. (Machine scored)

The Flanagan Aptitude Classification Tests
(Science Research Associates)

These tests were developed to help schools identify students who are gifted in various vocational fields and to help students establish future educational and vocational plans. Scores are provided for nineteen job tasks and may be used to identify student aptitudes in thirty-seven occupational areas. (Machine scored)

The Gordon Occupational Check List
(Harcourt, Brace and World, Inc.)

This check list provided the student with a choice of characteristics of basic occupations which seemed to be desirable to him. It is fundamentally a preference form and administered under relaxed conditions.

After completion of the lists they were returned to New York University where they were individually hand scored.

The Survey of Interpersonal Values
(Science Research Associates)

This check list was designed to measure critical values involving the individual's relationships to other people or their relationships to him. These values are considered to be important in the individual's personal, social, marital, and occupational adjustment. The six values measured included:

Support - being treated with understanding, encouragement, kindness, and consideration.

Conformity - doing what is socially correct, following directions, doing what is acceptable and proper.

Recognition - being looked up to and admired, achieving recognition.

Independence - having the right to do whatever one wants to do in one's own way.

Benevolence - doing things for others, sharing, helping, being generous.

Leadership - being in charge of other people, having authority over others.

The form consists of thirty sets of three statements or triads calling for a choice of most and least important.

Completed forms were returned to New York University to be hand scored.

School Records

The records of pupils were used for the purpose of obtaining intelligence quotients, reading scores, arithmetic scores, aptitude scores (Differential Aptitude Tests), and school marks so that their value as predictive instruments might also be considered.

Other Data

The scores obtained on standardized tests administered by the schools were also tabulated for use in the comparative study of scores for predictive use in vocational-technical guidance. The scores recorded were those obtained by schools as a result of intelligence, reading, arithmetic, and aptitude testing.

Teachers' marks obtained by students in actual subject work in school are also being used in the complete analysis of all data which may have predictive value.

Treatment of Data

Analysis of School Marks

Information received from six schools participating in the first part of the Pilot Study concerning the school subject marks or grades of twelfth grade pupils show that the majority of those pupils who had scored above the mean (58.79) on the achievement instrument as a whole were in the upper one third of their vocational group scholastically. This was also true in general of those pupils who scored above the mean

on the technical competency (27. 55) and above the mean (33. 68) on the performance parts of the achievement instrument. It was interesting to note that although the intelligence quotient alone cannot generally be considered a predictor of success, those pupils who scored above the mean on each of the criteria, with few exceptions, had intelligence quotients of above 100 with the majority of these pupils having intelligence quotients of 110 to 120.

Interest Inventories

The use of the Survey of Interpersonal Values seemed to indicate a consistency on the part of a majority of those pupils tested, according to the Survey, in their desire to be treated with understanding, kindness, and consideration. This value is termed "support" in the Survey. They also indicated a desire, according to the form, to be independent of others and to be free to make their own decisions. The use of the form indicates that pupils in Trade Electrical Shop desire to conform, to be looked up to, and to be admired in addition to their desire for support and independence. Although there seemed to be little difference between the values held by successful pupils (above the mean on the achievement instrument) and unsuccessful pupils it seemed obvious that most pupils interested in the two vocational areas tested have a tendency to have the values indicated. Responses on the Gordon Occupational Check List showed more interest in technical areas than in the other occupational areas included in this instrument. It is reasonable, however, to expect this response on the Check List by pupils who had completed three years of vocational training.

Statistical Treatment of Data

The scores obtained by pupils in the sub-tests of the Primary Mental Abilities Test, the Stanford Achievement Test, and the Flanagan Aptitude Classification Test were correlated, using Pearson Product-Moment Coefficient of Correlation, with pupil performance as reflected by three criteria measures. These criteria consisted of the scores obtained by the individual pupils tested on the technical competence and the practical achievement tests developed for use in this Study and the total combined scores on these two parts of the achievement instrument.

Data obtained by each of the six schools were first tabulated by schools and intercorrelations were computed between all sub-tests of the three standardized test forms. Separate tabulations by schools, however, were not used in the over-all interpretation of test results because an inspection of these results seemed to lack consistency between schools. This lack of consistency can probably be attributed to the small number of subjects in each sample and the tendency for a small number of scores in either direction in a sample of limited size to distort means, standard deviations and correlations. The sub-test scores obtained as a result of testing both ninth and twelfth grade pupils in the six schools were then combined and analyzed to discover possible correlations of sub-tests with each other.

Finally the sub-test scores of twelfth grade pupils were correlated with each other and then with the three criteria measures. These final correlations were first computed for all pupils tested including those pupils who had missed either a part of the entire battery or a part of the achievement instrument. These correlations, however, seemed to have value only in establishing the relationship of each of the sub-tests with other sub-tests and in providing information which may be of value in the counseling of individual pupils. Correlations were then computed on data obtained from test results of only those twelfth grade pupils in electrical and machine shop courses who had completed all parts of the test battery and both parts of the performance and achievement tests. Preliminary findings as stated in this report have been based on the analysis of scores obtained by those 114 pupils who completed all tests. The means and standard deviations for this combined group are shown in Table I. (page 16).

The statistical analysis of the scores obtained on the thirty sub-tests making up the three test forms showed little correlation (Pearson Product-Moment Coefficient of Correlation) between success in practical achievement (criterian measure II) on the performance part of the achievement instrument and scores on the various sub-tests. Correlations at the .05 level of significance were indicated only for certain sub-tests in relation to the technical competence part of the achievement instrument. When the scores obtained on the thirty variables by the electrical group alone (N=42) and the machine group alone (N=72) were compared with scores obtained on the three criteria (achievement instrument) it was found that there was little difference in the items which showed significant correlations for each separate group and those items which showed significant correlations for the combined groups. Further investigation will be necessary to determine the relative predictive values of each of the items or sub-tests.

Attempts were made to determine whether the predictive value of the various sub-tests would be increased by using multiple correlations. Because correlations between sub-tests were of a similar or larger magnitude than the correlations between sub-tests and the criteria measures, multiple correlations did not meaningfully increase. Intercorrelations of the thirty variables or sub-tests with the two parts of the achievement instrument and the combination of these scores to form a third criterion are shown in Table II. (page 17).

The Reduced Test Battery

An examination of the results of the scores on the standardized tests as compared with the achievement scores indicates that each test has some degree of predictive value in examining potential for competence in the two trade areas covered by the Study. Of the nineteen sub-tests included in the Flanagan Test, only four showed correlations which seemed to be meaningful in terms of predictive value for the groups tested. A decision was made to use each of the original tests in the predictive testing program during the Fall of 1966. However, only

TABLE I

MEANS AND STANDARD DEVIATIONS
(Primary Mental Abilities, Stanford Achievement Test, Flanagan Aptitude Classification Test)
COMBINED GROUP N = 114[a]

VARIABLE	TEST	SUB-TEST (Title Abbreviated)	MEAN	STANDARD DEVIATION
1	P. M. A.	Verbal Meaning	65.263	32.114
2		Number Facility	77.991	30.656
3		Reasoning	65.368	31.799
4		Perceptual Speed	77.614	27.537
5		Spacial Relations	76.763	29.921
6	Stanford	Paragraph	10.415	1.557
7		Spelling	9.245	1.912
8		Usage	8.774	1.628
9		Computations	10.281	2.071
10		Concepts	10.293	2.045
11		Applications	10.430	1.940
12	F. A. C. T.	Inspection	53.456	25.991
13		Mechanical	73.518	22.452
14		Tables	48.254	25.769
15		Reasoning	54.746	24.644
16		Vocabulary	46.368	22.436
17		Assembly	56.447	27.590
18		Judgment	52.465	25.697
19		Components	53.377	26.735
20		Planning	42.368	26.763
21		Arithmetic	56.640	28.344
22		Ingenuity	51.825	25.475
23		Scales	52.605	29.970
24		Expression	42.298	21.173
25		Precision	66.421	28.523
26		Alertness	25.921	7.215
27		Coordination	31.912	15.179
28		Patterns	15.711	9.549
29		Coding	97.833	27.750
30		Memory	15.316	12.416
31		Criterion I Theory	27.553	9.900
32		Criterion II Practice	33.675	10.883
33		Criterion III Total	58.789	21.080

[a]Variables 1-30: Predictor measures;
Variables 31-33: Criterior measures.

TABLE II

INTERCORRELATION MATRIX OF THIRTY VARIABLES WITH THREE CRITERION MEASURES

COMBINED GROUP N = 114

VARIABLE (Sub-test)	CRITERION I (Technical Competence)	CRITERION II (Performance)	CRITERION III Total Achievement)
1	.065	.035	-.063
2	.149	.059	.003
3	.124	.071	.001
4	-.001	.032	-.087
5	.207*	.148	.083
6	.231**	.003	.101
7	.214*	-.148	-.020
8	.150	-.103	-.022
9	.286***	.055	.114
10	.377***	.090	.169
11	.312***	.121	.148
12	.105	.036	.038
13	.239**	.108	.127
14	.070	-.054	-.015
15	.342***	.112	.167
16	.093	-.096	-.079
17	.193*	.088	.130
18	.260***	-.005	.080
19	.183	-.013	.058
20	.031	.009	.003
21	.130	-.004	-.041
22	.129	-.112	-.043
23	.238**	.017	.063
24	.120	-.189	-.128
25	-.101	.081	-.044
26	-.059	.021	-.054
27	-.073	.083	.017
28	.007	-.016	-.061
29	-.060	.041	-.051
30	.069	-.170	-.211

Levels of Significance

*	P<.05
**	P<.02
***	P<.07

the four sub-tests of the Flanagan Test which showed significant correlations with the criterion measures were administered on a state-wide basis. The elimination of fifteen of the variables or sub-tests reduced the entire testing time required from twenty-one hours to less than fourteen hours.

During the Fall testing, it was suggested that the interest survey forms might be administered separately and not as a part of the test battery. In schools where this was done, the formal "testing time" was reduced; administration of the test battery was easier; and the interest survey forms were filled out under less tension that they would have been under testing conditions.

Testing Entering Pupils

In the Fall of 1966, the two interest forms and the reduced battery of tests were administered to entering ninth grade boys in eleven State Vocational-Technical Schools. Three of the schools where entering students are admitted to the tenth grade, administered the test battery to all tenth grade boys. Data obtained as a result of this comprehensive testing of entering students will be used for analysis in a future phase of the Study.

Summary

Phase One of this research study began with the organization of a Study Team of professional consultants and the design of a committee structure for conducting the Study. A major part of the first phase of the Study was the Pilot Study involving six vocational-technical schools. A battery of preselected standardized tests were administered to about two hundred entering pupils in ninth grade classes and also to about two hundred twelfth grade pupils who were completing programs in Trade Machine Shop and Trade Electrical Shop. Achievement tests were constructed and administered to these same twelfth grade pupils. Scores of these twelfth grade pupils on the standardized battery were compared with the scores of the same pupils on the achievement tests. Some subtests of the original standardized battery showed little or no correlation when compared with achievement scores. A reduced battery of standardized tests was administered to all entering male pupils in the fourteen regional vocational-technical schools during the Fall of 1966. Scores on these tests will be used in making comparisons and future refinements of the predictive test battery to be used in a future phase of the Study.

Conclusions

The use of the standardized test battery in the Pilot Study has served to establish a desirable administrative plan and a necessary "ease of contact" for the future testing of pupils and the gathering of data in each of the fourteen schools. Difficulties of test programing, interrupted instruction, time requirements, and physical space needed for testing have each been explored. It is anticipated that these difficulties can be eliminated in future testing by continued planning and the ultimate reduction of the test battery through the continued analysis of test results.

An examination of test results obtained during the Pilot Study and an examination of literature in the field, indicates that interest surveys or inventories should be a part of the testing program and that these forms are more meaningful when administered before vocational training has started than after such training has influenced the development of pupil opinions. In general, these forms have more value as guidance tools when used as a basis for individual or group guidance than as actual predictors of probable success in trade areas. In future phases of the Study these forms may only be used to determine the interests of entering pupils.

Through the continued use of the test battery further reduction in the number of sub-tests employed may be made. It is reasonable to assume that through continued testing and the use of a refined achievement instrument a test battery more highly correlated and meaningful for use in prediction of vocational success can be developed.

Recommendations

The Study Team recognized from the beginning that it will take at least three years before conclusive evidence can be produced to support the predictive values of this preselected battery of standardized tests. Phase One of the Study has offered the Study Team an opportunity to collect data on students who are entering programs in the fourteen vocational-technical schools. This part of the Study has provided opportunity to try out procedures which made use of achievement tests on a limited basis.

The recommended steps for continuing the Study are outlined for a second phase which should follow immediately without interruption. The following recommended steps are designed to strengthen the findings in preparation for the time when comparisons can be made between the scores of beginning students on the predictive battery and the achievement of these same students at the conclusion of their courses in the twelfth grade:

1. Further refinement of the twelfth grade achievement instruments
2. Administration of the revised achievement instruments on a state-wide basis
3. Administration of the reduced battery of standardized tests to twelfth grade students in machine and electrical shops
4. Comparison of scores of twelfth grade students' achievement with scores on the standardized battery
5. Construction of an eleventh grade achievement instrument for machine and electrical shops
6. Administration of eleventh grade achievement instrument

7. Comparison of eleventh grade scores on achievement in Spring 1968 with scores these same students received on standardized battery in Fall 1966. This sample will also include those ninth grade boys from Bullard-Havens Technical School who were tested in the Spring of 1966.

The expected results of Phase Two of this Study should form a basis for a recommendation of a further reduced battery of standardized tests which may be administered to a sample of eighth grade students during Phase Three of the Study. It is conceivable that, as a result of procedures covered in Phase Two, the resulting battery of tests may be reduced to a series of sub-tests which may be conveniently administered in a three-hour testing period.

APPENDIX

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