DOCUMENT RESUME

ED 038 494 VT 009 903

TITLE	The Selection of Students for Entrance into Trade Programs in Public Secondary Schools.
INSTITUTION	New York Univ., N.Y. Center for Field Research and School Services.
PUB DATE	Jan 69
NOTE	256p.
AVAILABLE FROM	Center for Field Research and School Services, Press 51, School of Education, New York University, 32 Washington Place, New York, New York 10003 ($5.00)
EDRS PRICE	EDRS Price MF-$1.00 HC-$12.90
DESCRIPTORS	Admission (School), *Admission Criteria, Aptitude Tests, Bibliographies, *Industrial Arts, Interest Tests, Predictive Validity, Questionnaires, *Rating Scales, Secondary Schools, *Success Factors, *Trade and Industrial Education, Vocational Education
IDENTIFIERS	*New York

ABSTRACT

Research conducted during the two earlier phases of this study showed a definite correlation between certain knowledges, abilities, and aptitudes, and success in the trade machine shop and trade electrical shop programs. On the basis of this and other research and experience, this study sought to develop reliable evaluative instruments and procedures for the prediction of success in these trade areas. After an extensive review of literature and of existing programs and instruments, pilot studies of over 400 pupils were made, once to collect data for the format, structure, and content of an industrial arts checklist, and again to test a structured interview guide and interest inventory. The forms were then reevaluated and revised. The study indicated that non-cognitive, or behavioral characteristics of workers, are not only important to success but may be determining factors. Teachers, supervisors, administrators, and other specialists tend to agree that prediction and selection should take place at the eighth or ninth grade level and that it should be based on non-cognitive as well as cognitive characteristics of the student. Phases I and II are available as ED 019 437 and ED 024 813 respectively. (CD)

THE SELECTION OF STUDENTS FOR ENTRANCE INTO TRADE PROGRAMS IN PUBLIC SECONDARY SCHOOLS

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January, 1969

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WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-2898

April 22, 1969

Dr. Louis A. Cohen, Chief
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The University of the State of New York
The State Education Department
Albany, New York 12224

Dear Dr. Cohen:

In fulfillment of an agreement dated October 1, 1967 between the New York State Education Department and the Center for Field Research and School Services, I am pleased to submit 250 copies of a report entitled, The Selection of Students for Entrance into Trade Programs in Public Secondary Vocational Schools.

The New York State Education Department deserves commendation for establishing a cooperative relationship which made it possible to complete this significant study. 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 counsel, 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 education in New York and elsewhere. To this end, the Study Director and his team are prepared to assist with the presentation and interpretation of the report.

New York University and its Center for Field Research and School Services look forward to a continued association with the State of New York in this important research endeavor.

Respectfully submitted,

Lou Kleinman

Lou Kleinman
Associate Dean

LK:fjs

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PART I

THE SELECTION OF STUDENTS FOR ENTRANCE INTO TRADE PROGRAMS IN PUBLIC SECONDARY SCHOOLS

Introduction

Methods of selecting students for entrance into trade or vocational programs in public secondary schools has demanded and continues to demand the attention of administrators, guidance counselors, and teachers alike.

It is the purpose of our educational system to provide the most efficient and effective educational program that can possibly be provided for all people in terms of their abilities, needs, aptitudes, and aspirations. It is therefore fitting that those engaged in guidance and in trade and vocational education carefully guide each student toward an area of education and employment in which success can be achieved, and which will provide the means and satisfactions necessary to mental, social and economic adjustment to society.

The careful occupational career guidance of individual students should be a primary objective of guidance counselors to ensure that students time is utilized to the fullest extent and to ensure maximum student satisfaction with his chosen occupation. The development of meaningful and appropriate curriculum design, the adjustment of the methodology of instruction, and effective and efficient administrative planning all contribute to this objective.

Because of limited guidance information, students may inadvertently be deprived of an opportunity for trade or vocational training or may be unwisely guided toward trade training. Either of these problems can be costly

to both the student and the trade training program.

Students with the ability to succeed in academic subjects may be assumed by some to be best fitted for purely academic pursuits. This assumption may be held without consideration for characteristics which indicate that the student is interested in and could be successful in trades or trade related occupations. Others with seemingly limited academic ability may be placed in trade or vocational training without regard for the nature of their limitations or interests, needs, and aptitudes because of the belief that they may not succeed in the "academic" areas of instruction.

A continuing program of student evaluation, guidance, and program adjustment would seem to be necessary if the student is to derive maximum benefit from the vocational curriculum.

It is reasonable to believe that research relative to the development and use of instruments of selection for trade or vocational training can contribute to the reduction of individual failure in training programs and to the reduction of the number of students who leave school without completing training.

Status of Prediction and Selection

Although various procedures for prediction of success and selection of students for entrance into trade programs in secondary schools have been used throughout the country, there has been a limited research effort in this area. Research results seem to indicate that there are few achievement tests, aptitude

tests, attitude scales, occupational inventories, or other instruments which may be used independently or as a battery as reliable predictive instruments.

Various methods of identifying potential students and employees have been used by schools and industry in the interest of efficiency in trade training programs and in employment situations. However, there seems to be no established pattern in either education or industry for the selection of students or workers, or for the use of predictive measures as guidance instruments. This seems to be particularly true in relation to secondary school trade programs. Research in this area has been generally concerned with prediction on the young adult or adult level rather than with eighth or ninth year students prior to entrance into a regular secondary school trade or vocational program.

Results of limited research relative to predictive testing and selection does seem to indicate that certain knowledges, skills, aptitudes, and personality and character traits are necessary for success in various occupations. Ability in certain areas of knowledge and certain attitudes, however, seem to be essential for success in specific individual trades and occupational areas.

The Purpose of the Study

It is the purpose of this study to determine attributes of success in the machine and electrical trades and to develop a predictive instrument or instruments to be used in the prediction of this success.

Expected Outcomes

It is expected that this study will result in the development of efficient and reliable evaluative instruments and procedures which can be used in the prediction of success in trade electricity and machine shop courses on the secondary level in the State of New York. It is hoped that the present report will serve as a frame of reference for continued research and the ultimate achievement of this outcome.

Limitations of the Study

Because this study is concerned with the selection of students for entrance into trade programs in public secondary schools a major emphasis has been placed on prediction and selection of students during the 8th and 9th grades. The scope of the study has further been limited to the consideration of attributes of success in and the development of instruments for entrance into training for machine and electrical trades.

Development of the Study

Early in 1966 New York University in conjunction with the State of New York and the State of Connecticut engaged in a cooperative study of predictive testing for entrance into vocational-technical schools. The purpose of this study was to identify effective instruments for prediction for vocational success in the form of a battery of standardized tests. Connecticut

was chosen for the study because of the uniformity of the instructional program and facilities in fourteen state operated vocational-technical schools.

The purpose of identifying effective selection instruments was that of providing counselors with reliable tools for the identification of vocationally talented students who could be expected to prove successful in certain program areas common to vocational-technical schools.

The study was further defined to include high school programs in trade machine shop and trade electrical shop. These two specific areas in the school program were selected because of their program similarities and their size in terms of pupil population. As a result of study and research in the State of Connecticut during 1967 and 1968 (Phase I and II of the study) there seems to be definite correlation between certain knowledges, abilities, and aptitudes, and success in the two trade areas studied. The findings of research and experience in predictive testing and student selection in other states, cities, colleges, and in industry throughout the country seem to substantiate the relationship of certain abilities, characteristics, and personality traits with success in industrial occupations. On the basis of this past research and experience in selection for vocational occupational training, The Center for Field Research and School Services, of the School of Education of New York University, under the auspices of the New York State Education Department, Bureau of Occupational Education Research has undertaken the continuation of the study of predictive testing.

In July, 1967 representatives of the New York State Department of

Education, in discussions relative to the design of this continued study of predictive testing, suggested the revision of the test battery previously used and the modification of the approach to solving the problem of the selection of students for secondary school trade programs. A broad approach to selection rather than the use of existing instruments alone for the prediction of success was suggested.

In August, 1967 continued discussions resulted in a modified and fundamental approach to the problems of selection, and in the outline of procedures to be employed in the study. The outline proposed at this time follows:

A. A complete and comprehensive review of literature dealing with predictions of student vocational success, exploring such elements as learning factors, behavioral factors, status-role factors, conceptual factors, and any other areas deemed significant by the investigators.

B. Exploration of existing programs of predictive testing.

C. Exploration of existing instruments that might be employed in the selection of students into trade programs.

D. Selection and/or development of instruments for selection and prediction in New York State secondary school trade training programs.

E. Pilot study (procedure to be determined by the study team).

F. Re-evaluation and modification (if necessary) of the instrument.

G. Presentation of findings in the form of a written report.

Procedures Followed

In order to discover data,procedures, and research findings which might be of value in the delineation of the attributes of success in machine and electrical trades and in the development of a predictive instrument to determine this success the following steps were taken:

A. A complete and comprehensive review of literature dealing with prediction of student vocational success and selection for entrance into trade training programs was undertaken.

B. Existing programs of predictive testing and selection in vocational education and industry were explored.

C. Existing standardized instruments that might be employed in the selection of students into trade programs were reviewed.

D. An in-depth workshop seminar with experts in the field of secondary, trade, and industrial education was conducted for the purpose of establishing criteria for "student success" and of obtaining other suggestions for effective methodology and the further development of the research design for this study.

As a result of the workshop seminar interviews with experts in vocational education and responses to questionnaires, it was recommended that the investigation of the use of the structured interview, industrial arts checklist, school marks, and standardized test scores as prediction and selection measures be conducted.

E. The use of the structured interview and of interest inventories as related to the structured interview was explored for the purpose of developing such an instrument for use in prediction and selection.

F. The use of an industrial Arts checklist was explored for the puspose of developing such a form for use in prediction and selection.

G. School marks as determinates of success in vocational education were explored for the purpose of formulating a procedure for the use of school marks in prediction and selection.

H. A structured interview guide and interest inventory was developed specifically for use in the 8th and 9th grades.

I. An industrial arts checklist and profile sheet was developed for the use of industrial arts teachers in rating characteristics which may have meaning in prediction and in the selection of students for trade training programs.

J. A preliminary or pilot study involving over 400 pupil was undertaken for the purpose of collecting data relative to the format, structure, and content of the industrial arts checklist.

K. A similar preliminary or pilot study involving over 400 students was undertaken using the structured interview guide and interest inventory.

L. Forms developed for this study were reevaluated, modified, and revised in relation to findings resulting from the pilot study.

Format

The study report has been divided into three parts.

Part I consists of a description of the study, a review of related literature and research, and the development of the research design for the study.

Part II contains information pertinent to the development and use of instruments which may be employed in the educational guidance of students with specific references to placement in secondary school trade training programs.

Part III is concerned with the development and experimental use of guidance instruments developed specifically for use in this study with specific reference to implications of the information presented in Parts I and II.

Organization of the Study

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 appointed as the policy-making committee for development of the research design and for various aspects of the study. Members of the 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. The Executive Committee members were consulted periodically during the period of the study to determine steps to be taken in its continuing development. Because of the nature of the study, an Action Research procedure was followed. Monthly programs 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 met in Syracuse early in the study to provide information basic to the development of the research

design to be used. Members of this committee have been contacted individually for advice regarding instrument development, the administration of pilot studies and for the collection of other necessary data. Members of this committee represented the directors of vocational education programs and guidance coordinators on various levels and areas of the State and the Bureau of Occupational Research. A list of members appears in the appendix (p. A-1).

Planning-Action Committee

The Planning-Action Committee was comprised of guidance counselors and specialists in the areas of industrial arts, trade machine shop and trade electrical shop. Representatives from the other committees served as members of this committee in an advisory capacity. Members of The Planning-Action Committee worked directly with the N.Y.U. Study Team in the programing of meetings, the collection of data and the administration of the pilot trials of instruments developed for the study. A list of members of this committee appears in the appendix (p. A-2).

N.Y.U. Study Team

The N.Y.U. Study Team was composed of a Director of the Study and three consultants who had the major responsibility for the material included in the study. Names of members of this team appear in the appendix (p. A-1).

Special Consultants

Special consultants and research assistants contributed to the development of the study and in the collection and analysis of data. Names of consultants and research assistants are also listed in the appendix (p. A-2).

REVIEW OF RELATED LITERATURE AND RESEARCH

This section of the study is concerned with a complete and comprehensive review of literature dealing with the prediction of vocational success and the selection of students for entrance into trade training programs.

In the presentation of the studies reviewed, the following reference categories were established:

1. Standardized Test Batteries
2. Interest Inventories
3. School Grades
4. Structured Interview
5. Industrial Arts Teachers Ratings
6. Miscellaneous

Each study was placed under an appropriate category on the basis of the conclusions reached as a result of the study. Studies have been presented in chronological order under each of the categories. The inclusion of a particular study in one category does not necessarily mean that the study deals with only one predictive variable. Most studies reviewed include a number of predictive variables which might have placed them under more than one of the established categories. All predictive variables utilized in the studies have been reported.

Summary statements regarding each of the reference categories appear in the first section of Part II.

Standardized Test Batteries

The Differential Aptitude Test Battery

Hall conducted a study to investigate the performance of certain occupational groups on the Differential Aptitude Test Battery. The purpose of his study was to provide the guidance counselor with information to help students in making vocational choices. The D.A.T. test battery was administered to 287 boys prior to their graduation from high school. Two years later these same boys were classified into six groups according to their occupations. Hall found that the means of the discriminant score distributions for clerks, salesmen, and skilled groups appeared to be closely related in terms of their Differential Aptitude Test scores. The mechanical, electrical, building trades, and unskilled groups also appeared to be closely related on their D.A.T. scores and could represent a family of occupations.[1]

Stoughton investigated the usefulness of the Differential Aptitude Tests in predicting success in Connecticut Technical schools. He found that the D.A.T. tests can be used for predicting probable success in the technical and vocational school program and, to a limited extent, for differential prediction. The Verbal Reasoning and Numerical Ability tests, Stoughton found, "...have a relatively high relation to success in all

[1] Robert C. Hall. "A Study of the Relationships Among Certain Occupational Groups in Performance on the Differential Aptitude Test Battery." (Unpublished doctoral dissertation, University of Connecticut, 1954)

general education and shop courses." He reports that Clerical and Spelling tests have little usefulness in predicting success in most vocational areas. The most useful tests in the vocational areas were the Abstract, Space, and Mechanical tests. In contrast to Hall, Stoughton indicates that auto, carpentry, drafting, electrical and machine shops should not be grouped as one occupational family because of the differences in the abilities required for success in the five shops studies.[2]

Mendicino studied "The Effect of Certain Educational Experiences Upon Achievement in Mechanical Reasoning and Space Perception" to determine the usefulness of aptitude testing as a guidance instrument to estimate "...the probabilities that a person will be able to follow successfully an occupation he is considering." He compared a group enrolled in a course in machine shop and related mechanical drawing with a control group not exposed to these experiences. He found that there was no significant difference between experimental and control groups on the basis of the pre-test and post-test means of the D.A.T. Mechanical Reasoning Test and Space Relations Test.

These results, Mendicino indicates, demonstrate that individuals possess the particular traits measured from the beginning, i.e. they are innate, because no significant modifications occurred from experience. Therefore, "...tests of mechanical reasoning and space perception become of utmost

2 Robert W. Stoughton, "The Differential Predictive Values of the Differential Aptitude Tests in the Connecticut Technical Schools." (Unpublished doctoral dissertation, the University of Connecticut, 1955)

importance, and the vocational schools through the guidance program are justified in using them to select and reject students for the vocational machine shop curriculum." Mendicino states that "the predictive value inherent in valid tests of mechanical aptitude must be acknowledged and utilized." He also states that:

> if the school is to offer a broad-gauge look at students' career possibilities, it must separately survey as many of the skills and abilities of its students as it can in order to arrive at judgments as to which areas of endeavor are likely to be most promising for each individual. This can be done by setting up a satisfactory comprehensive battery of measures of aptitudes, and establishing patterns of profiles to govern the eligibility of students to enter certain programs.[3]

Doppelt, Seashore and Odgers surveyed the extent to which the Differential Aptitude Tests were useful in predicting success of students in auto mechanics and machine shop. The criterian data selected were teacher grades and teacher ratings on understanding of trade information, job know-how, quality of work, and quantity of work. The investigators found that teacher grades were not a stable measure from school to school and they were, therefore, dropped as a criterion. The investigators found that the DAT was not an effective predictor of success in auto mechanics. For Machine Shop students they found "...the relationships between the Differential Aptitude Tests and ratings were sufficiently high to permit useful predictions of how students will be rated on all traits. The sum

[3] Lorenzo Mendicino. "The Effect of Certain Educational Experiences Upon Achievement in Mechanical Reasoning and Space Perception," (Unpublished doctoral dissertation, University of Pittsburgh, 1955)

of scores on the DAT Mechanical Reasoning, Space Relations, and Abstract Reasoning Tests was selected as a predictor of Both Grade 11 and Grade 12 ratings.[4]

Foote used a battery of standardized paper and pencil tests, consisting of verbal and non-verbal I.Q., three mechanical aptitudes, arithmetic, reading and Kuder Vocational Preference Record to determine their usefulness in predicting success in automotive mechanic. He found that arithmetic, D.A.T. Mechanical Reasoning, S.R.A. Mechanical Aptitudes (Spatial Relations and Mechanical Knowledge parts) and Kuder Persuasive scale were "...significant in the prediction of graduation from the automotive curriculum, continuing into the second half of the curriculum, performance test scores, and related technical subject term grade averages."[5]

Ewald studied the usefulness of the Differential Aptitude Tests and the American Council on Education Psychological Examination to predict success in vocational education and other subject areas. Contrary to other research results Ewald found that the Mechanical Reasoning test of the D.A.T. was not highly effective in predicting grades in vocational education. He also found that 10th grade scores on the D.A.T. "...were generally significant predictors of the tendency to remain in high school until graduation."[6]

4 J.E. Doppelt, Seashore and Odgers. "Validation of the Differential Aptitude Tests for Auto Mechanics and Machine Shop Students," Personnel and Guidance Journal, 37:648-55, May, 1959.

5 Richard P. Foote. "The Prediction of Success in Automotive Mechanics in a Vocational-Industrial Curriculum on the Secondary School Level," (Unpublished doctoral dissertation, New York University, 1960)

6 Hattie H. Ewald. "The Relationship of Scores on the Differential Aptitude Tests to Scholarship in High School and College." (Unpublished doctoral dissertation, State University of South Dakota, 1961)

The General Aptitude Test Battery

Samuelson observed that vocational students are often accepted into a trade area on their stated preference rather than by a method that would increase their probability of success. "...It has", Samuelson states "remained the practice to give all but the obviously unfit the opportunity to try courses of their choice to demonstrate whether the training could be profitable to them". He investigated the usefulness of the General Aptitude Test Battery in predicting the success of vocational students. His sample included students in the vocational areas of: Auto Body and Fender, Auto Mechanics, Carpentry, Diesel Mechanics, Electronics, and Welding. He concluded that the GATB was a statistically significant predictor of student success in the vocational areas of Body and Fender, Auto Mechanics, Carpentry, and Electronics.[7]

Tate studied the relationship between scores on the General Aptitude Test Battery and achievement in vocational and technical courses. He found that "there is a significant," (.05), "relationship between aptitude scores on the GATB and course grades in selected vocational and technical courses."[8]

7 Cecil O. Samuelson. "General Aptitude Test Battery in Predicting Success of Vocational School Students," Journal of Educational Research, 50:175-82, November, 1956.

8 Forest E. Tate. "The Relationship Between the General Aptitude Test Battery and Achievement of Eleventh Grade Students in Selected Vocational and TEchnical Courses." (Unpublished doctoral dissertation, University of Missouri, 1965)

Traxler appraised General Aptitude Test Battery scores as a predictor of success in the technical and vocational areas. He concluded that the test was a useful instrument in counseling and placement because a student could be shown on the basis of GATB scores, the probability of his success or failure. The GATB, Traxler states, "...showed greater predictive validity in core areas in which success was more dependent upon manual than verbal abilities."[9]

Ingersoll and Peters studied the use of the General Aptitude Test Battery for identification and counseling of vocational and academic students. They found that they could significantly predict, in most instances, vocational and business course grades from the students' aptitudes scores on the GATB..." Form Perception and Verbal Aptitude were significant variables for predicting success in mechanical drawing.[10]

Droege reports on a study conducted by the United States Employment Service "...to determine the relative validity of unadjusted and age-adjusted General Aptitude Test Battery (GATB) aptitude scores for predicting occupational success." For each of eleven samples the validities of unadjusted and age-adjusted scores were compared for the nine GATB aptitude measures.

9 Howard W. Traxler. "Determining the Usefulness of the General Aptitude Test Battery in Predicting Student Success in a Technical Vocational High School." (Unpublished doctoral dissertation, Univ. of Denver, 1966)

10 R. W. Ingersoll and H. J. Peters. "Prediction Indices of the GATB," Personnel and Guidance Journal, 44:931-7, May, 1966.

The results indicated that some GATB aptitude scores which were age-adjusted had validities which were significantly higher than the unadjusted scores.[11]

Pucel and Nelson report on the Minnesota Student Characteristics and Occupationally Related Education project to study the selection and counseling of vocational students for post-high school vocational programs. The instruments used were: a personal information sheet, the written parts of the GATB, the Minnesota Vocational Interest Inventory, the Minnesota Importance Questionnaire, the Vocational Development Inventory, and the Minnesota Scholastic Aptitude Test. They found that all the instruments seemed to "...be measuring relatively independent variables and each was capable of significantly differentiating at least two of the 18 different curriculum groups at the .05 level..." They also found that by using a combination of the General Aptitude Test Battery, the Minnesota Vocational Interest Inventory, Sixteen Personality Factors Questionnaire, and the Minnesota Importance Questionnaire clusters of trades consistently grouped together. This, the authors state, suggests that individuals in the groups are similar on many dimensions. The instruments used identified similar needs, interests, abilities, and personalities of students within each cluster of vocational areas.[12] This investigation is reported in greater detail later in this study.

11 Robert C. Droege. "Effects of Aptitude-Score Adjustments by Age Curves on Prediction of Job Performance." Journal of Applied Psychology, 51:181-86, April, 1967.

12 Howard F. Nelson and David J. Pucel. "Project MINI-SCORE: Some Preliminary Implications for Vocational Guidance." Department of Industrial Education, University of Minnesota, 1968 (Mimeographed)

The Employee Aptitude Survey

Ruch appraised selected tests in the Employee Aptitude Survey in predicting success in draftsman training. The tests of the EAS used were Verbal Comprehension, Numerical Ability, Visual Speed and Accuracy, Space Visualization, Numerical Reasoning, and Verbal Reasoning. Ruch reports that "Validity coefficients of Numerical Ability, Visual Speed and Accuracy, Numerical Reasoning, and Verbal Reasoning were all significant at the .01 level, and the validity coefficient of Space Visualization was significant at the .05 level." He concludes "...that success in draftsman training could be predicted by short time limit aptitude tests."[13]

Broe studied the prediction of success in the training of electronics technicians at the Junior college level. He found that the most significant (.01) independent variables as related to the "Composite Criterion" were "extent of trainee planning, intensity of motivation, grade expected by the trainees in their major courses," Employees Aptitude Survey Tests of "Verbal Comprehension, Numerical Ability, Symbolic Reasoning, along with the three School and College Ability Tests..." Broe reports that "...the best prediction of future success occurs at the earliest levels of training..." At the first year of training, he found the EAS Verbal Comprehension and Numerical Ability Tests were the best predictors while at the second year the EAS Symbolic Reasoning and High School Grade-Point Average were the best predictors.[14]

[13] F.L. Ruch, and W. W. Ruch. "Predicting Success in Draftsman Training with Short Time Limit Aptitude Tests," Educational and Psychological Measurement, 20 No. 4:827-33, Winter, 1960.

[14] John R. Broe. "Prediction of Success in Training Among Electronics Technicians." (Unpublished doctoral dissertation, University of Southern California, 1962).

Other Standardized Tests and Test Batteries

Kefauver studied the relationship of scores on the MacQuarrie Mechanical Ability Test, the average of Test I and II of the Stenquist Mechanical Ability Test, and the Terman Group Test of Mental Ability, Form A, with pupils' success in the machine, electrical, automobile, and mill-cabinet shops. The highest correlations discovered were: for the electrical group, the Terman I.Q. Test, (.58± .08), for the machine shop group, the Stenquist Test, (.65± .09), and for the mill-cabinet group, the MacQuarrie Test (.63± .10). In automobile mechanics, the correlations were low, the highest being with the MacQuarrie Test (.15± .13). Kefauer found that the requirements for success were quite different from course to course and that the tests used varied in their accuracy in measuring the abilities necessary to be successful pupil.[15]

McDaniel and Reynolds used the Bennet Test of Mechanical Comprehension, the MacQuarrie Mechanical Ability Test, and the O'Rourke Test of Mechanical Ability, Junior Grades, Form C, as a test battery to predict success in machine shop, aircraft engines, aircraft mechanics, woodshop, and welding. They found that the predictive value of the battery differed from course to course, but "...its over-all value is significant in showing that prediction formulas need not be confined to one type of training." They also found

15 Grayson N. Kefauer. "Relationship of the Intelligence Quotient and Scores on Mechanical Tests with Success in Industrial Subjects." The Vocational Guidance Magazine. Vol. III, No. 5, February, 1929.

that the battery subtests of MacQuarrie Tapping and Dotting Tests, with the O'Rourke General Mechanical Information Test, contributed most to the predictive efficiency of the battery.[16]

Ghiselli and Brown studied the validity of the aptitude test in predicting the trainability of workers. They surveyed the literature from the year 1919 to 1951 in an attempt to investigate the usefulness of aptitude test scores as predictors of trainability. They report that in the trades, the best predictors of trainability are tests of intelligence, spatial relations and mechanical principles. However, the aptitude test scores that were found to be the most effective predictors of trainability for one occupational group were also found to be effective predictors for the other occupational groups studied. Therefore, the investigators state, differential prediction is a difficult task. For mechanical repairmen and electrical workers intelligence, arithmetic, spatial relations and mechanical principles had "...moderately high validity coefficients."[17]

Weiner compared vocational dropouts and graduates in an attempt to develop a predictive instrument that would assist in identifying the dropout student. He compared the groups on the basis of age upon entry into high school: tardiness during the earlier schooling; term repeating; achievement;

16 J.W. McDaniel and W. A. Reynolds. "A Study of the Use of Mechanical Aptitude Tests in the Selection of Trainees for Mechanical Occupations." Educational and Psychological Measurement. Vol. 4, 1944, pp. 191-197.

17 Edwin E. Ghiselli and Clarence W. Brown. "Validity of Aptitude Tests for Predicting Trainability of Workers." Personal Psychology. Vol. 4, pp. 243-260; 1951.

and I Q. Term repeating and achievement were found to be of little usefulness and were dropped as items of comparison. Weiner found that there was a significant difference (.01) between the dropouts and graduates on the variables of age upon entry into high school, absences during the earlier schooling, tardiness during the earlier schooling and I.Q.[18]

Bradley investigated two groups of students enrolled in trade and technical courses in an attempt to identify variables that would predict student success. A biographical questionnaire, the Army General Classification Test, the Bennett Mechanical Comprehensive Test, Form AA, and the Revised Minnesota Paper Form Board, Form MA were administered to both groups. In addition the Kuder Preference Record-Vocational, Form BM was administered to Group I while the Minnesota Vocational Interest Inventory and the Woody-McCall Mixed Fundamentals in Arithmetic, Form I was administered to Group II. Bradley found that three of the variables, the Army General Classification Test, the Bennett Mechanical Comprehensive Test, and the Revised Minnesota Paper Form Board were the best predictors of success in technical and skilled trade courses. These variables had an average coefficient of correlation of .69 with students achievement, the criterion used to measure the success of students.[19]

18 Nathan Weiner. "Predicting the Dropout Student in a New York City Vocational High School: A Comparative Analysis of Pre-High School Records of Early School Leavers and High School Graduates," (Unpublished doctoral dissertation, New York University, 1957)

19 Arthur Kickinson Bradley. "Estimating Success in Technical and Skilled Trade Courses Using a Multivariate Statistical Analysis." (Unpublished doctoral dissertation, University of Minnesota, 1958)

Campbell studied "The Relationship Between the Wechsler-Bellevue Scale and High School Achievement." He found that the "Wechsler-Bellevue performance I.Q.'s gave some indication of subsequent achievement in shop (0.69) and home economics (0.49)." The "...verbal scale I.Q. and full scale I.Q. gave some indication of his subsequent grade point average. The fact that the relationship between verbal scale I.Q. and grade point average (0.50) was significantly greater than was the relationship between performance scale I.Q. and grade point average (0.32) suggested that the functions measured by the verbal scale were the significant ones in both academic and non-academic subjects." Campbell also concluded that the use of the Wechsler-Bellevue scores was similar to the use of I.Q. scores in predicting achievement.[20]

Carlin investigated the use of standardized test scores, obtained from prior records, in intelligence, reading, and arithmetic, as predictors of success in automotive, electrical, and woodworking courses. He found that there were significant differences, (.01) in mean intelligence and mean arithmetic scores between graduates and drop-outs. In the electrical courses, he found a significant difference (.01), between graduates and drop-outs in mean reading scores. Carlin concluded that "the critical arithmetic score was the best individual predictor of success. The critical

20 J. Chandler Campbell. "The Relationship Between the Wechsler-Bellevue Scale and High School Achievement." (Unpublished doctoral dissertation, Indiana University, 1959).

intelligence score was the second best individual predictor of success."[21]

Drew studied a group of machinist apprentices to determine the relationship of performance on the Diagnostic Reading Tests, California Short-Form Test of Mental Maturity, Advanced 50 Form, Kuder Preference Record-Vocational, Purdue Mechanical Adaptability Test, Bennett's Test of Mechanical Comprehension and job performance. Drew found that "...the relationships between the various reading scores and school grades were positive and significant at the .05 level." He found that the total comprehension score, the effective reading rate, and the mental maturity score were the most promising predictors of school achievement. "For job performance ratings, the mechanical adaptability score and the effective reading rate were the most promising predictors..." He also found that "mechanical interest was not related significantly to either school or job performance."[22]

Berry tested students with behavioral disorders to determine the relationship between certain predictive variables and successful completion of vocational training. She used the Wechsler Adult Intelligence Scale, the Jastak Wide Range Achievement Test, prior educational or grade level, and the age as predictive variables. Berry found that none of the variables were significantly effective in predicting the success of students in

21
Francis X. Carlin. "Intelligence, Reading, and Arithmetic Scores as Predictors of Success in Selected Vocational High Schools." (Unpublished doctoral dissertation, Fordham University, 1962)

22
Alfred S. Drew. "The Relationship of General Reading Ability and Other Factors to School and Job Performance of Machinist Apprentices." (Unpublished doctoral dissertation, The University of Wisconsin, 1962)

vocational training.[23]

Anderson examined seventeen (17) academic variables for their usefulness in predicting success. The variables that differentiated between graduates and nongraduates were "...(1) composite, mathematics, and English scores on the American College Test (ACT), (2) grades in high school mathematics, and (3) cumulative grade point average. All of these correlated reliably with grade point average for electronics, architectural drafting, and industrial drafting programs." In predicting success in vocational areas, Anderson found that the best single predictor for each program was "...(1) ACT natural science for architectural drafting, (2) ACT mathematics for civil engineering, (3) high school mathematics for electrical, (4) ACT composite for industrial drafting, (5) Flanagan Aptitude Classification Test (FACT) components for refrigeration, and (6) FACT ingenuity for electronics."[24]

Crawford investigated an experimental battery of twenty-one standardized tests to identify batteries of tests which would be effective predictors in specific trade areas. In the development of a battery for electronic technicians she found, on the basis of correlations of aptitude test scores and instructors' ratings of student performance, that a battery consisting of (1) Science Research Associates, Mechanical Aptitudes Shop Arithmetic,

23 Rose A Berry. "An Analysis of the Relationship Between Certain Variables of Students with Behavioral Disorders and Successful Completion of Vocational Training." (Unpublished doctoral dissertation, University of Arkansas, 1966).

24 Roger C. Anderson. "Predicting Achievement in Technical Programs at the North Dakota State School of Science." Research Report No. 2, Center for Research in Vocational and Technical Education, College of Education, University of North Dakota, October 1966.

(2) Guilford-Zimmerman Aptitude Survey, Part 6 Spatial Visualization, (3) Progressive Matrices (non-speeded and non-verbal reasoning) and (4) Primary Mental Abilities, Word Fluency was an effective predictor of success. The battery administered to beginning students had a correlation Multiple R .68 between the total battery score and instructor performance ratings. In machine-shop a battery of (1) Guilford-Zimmerman Aptitude Survey, Part 4 Perceptual Speed and Part 7 Mechanical Knowledge, (2) Army General Classification Test, Arithmetic (3) Guilford-Zimmerman Temperament Survey, "E" Emotional Stability and (4) Dexterity Preferred Hand was found to have a correlation Multiple R .75. In addition to the tests an "applicant-instructor-counselor interview was used to consider such factors as health, age, work experience and training.[25] This study is reported in greater detail later in this study.

Prediger, Waple, and Nusbaum reviewed the literature from 1954 to 1967 on predicting success in vocational education.

Each study was listed under a vocational subject and included in one of the following test categories, (1) verbal intelligence and academic aptitude, (2) nonverbal intelligence and abstract reasoning, (3) arithmetic reasoning and computation, (4) spatial aptitude including spatial visualization, spatial relations, etc., (5) mechanical principles, comprehension, knowledge, reasoning, etc., (6) perceptual speed and accuracy, (7) manual dexterity,

25 Margaret L. Crawford. "Available Tests and Their Use in Research in Vocational Education." Los Angeles Trade and Technical College, California, March, 1966.

(8) specific purpose aptitude tests, (9) past grades and (10) achievement test data. Median correlation coefficients were determined for all studies included in each category. They report considerable variation in results and suggest that trying a predictive instrument in a particular situation is the only method for evaluating its effectiveness. The variation of predictors from area to area reveals, the author state, "...a surprising amount of differential predictability..." They found that the I.Q. as a predictor "...would appear to be unfair to many students." Also, perceptual speed and accuracy tests and tests of manual dexterity "...appear to contribute relatively little to the prediction of success in the areas surveyed."[26]

In Connecticut a study of the use of five standardized test forms for the prediction of success in trade machine shop and trade electrical shop was conducted. The test forms included Primary Mental Abilities, the Stanford Achievement Test and the Flanagan Aptitude Classification Test. The Gordon Occupational Checklist and the Survey of Interpersonal Values were also administered. The study was conducted over a three year period: as a concurrent study during the first phase and a longitudinal study in its second phase. Although the sample used in the first phase of the study was large enough to permit significant comparisons in a longitudinal study the number of students remaining in the study at the end of the second phase was too small to permit meaningful conclusions.

26 Gerald Nusbaum, Dale J. Prediger and Charles C. Waple. "Predictors of Success in High School Level Vocational Education Programs: A Review, 1954-1967" The Personnel and Guidance Journal, Vol. 47, No. 2, October, 1968. pp. 137-145.

As a result of the study, however, it was possible to reduce the original test battery consisting of 30 variables to 15 variables or subtests and to distinguish, to some extent, differences in measurable abilities between students in trade machine shop and students in trade electricity. This study seems to be the only one available which reports a study of prediction for entrance into secondary school trade or vocational training programs.[27] The study is reported in greater detail in a following section of this report.

Interest Inventories

Cooper assessed the effectiveness of the Strong Group Scales in predicting drop-outs, number of changes of major, and grade point average at the college level. He found that the group scales were not effective predictors, and he questioned the usefulness of the scales in counseling students when a broad area of occupations was being considered.[28]

Shaw investigated the usefulness of the Kuder Preference Record-Vocational, Form BB, as a measuring instrument to be used by the guidance counselor in assisting students in the selection of curriculum areas. He

27 New York University Center for Field Research and School Services. "Predictive Testing for Entrance in Vocational Technical Schools," August, 1968.

28 Alva C. Cooper. "A Study of the Group Scales of the Strong Vocational Interest Blank as Predictors of Academic Achievement and of the Relationship of the Group Scales to Primary Interest Patterns." (Unpublished doctoral dissertation, Columbia University, 1954).

found that "the vocational curriculum was selected more frequently by the students who ranked above the 75th percentile in the mechanical and social service interest areas than by those ranking below the 25th percentile. The difference was significant at the five per cent level." Shaw also reported that the boys in the vocational curriculum ranking above the 75th percentile on the mechanical interest area obtained "significantly higher marks: than those ranking below."[29]

Reisner conducted a study to determine the influence of personality factors, ability and aptitude variables in vocational aspiration. He divided his sample into three groups, Over-Aspirant, Appropriate and Under-Aspirant. He found that the Appropriate group scored significantly higher than the other combined groups on the Emotional Stability and Masculinity Scales. The Appropriate group also scored significantly higher "...in general intelligence, ability to deal with spatial relations, mechanical comprehension and clerical aptitude involving verbal material." The Appropriate and Over-Aspirant groups scored significantly higher than the Under-Aspirant group on the Level of Interests scale of the Lee-Thorpe Occupational Interest Inventory. There were no significant differences among groups on scales of the personality inventory.[30]

29 Carl E. Shaw. "An Investigation of the Validity of the Kuder Preference Record-Vocational for Educational Guidance," (Unpublished doctoral dissertation, Purdue University, 1954).

30 Martin Reisner. "A Comparative Investigation of Personality Factors Associated with Appropriate and Inappropriate Levels of Vocational Aspiration." (Unpublished doctoral dissertation, New York University, 1956).

Crites studied the role of ability and adjustment in vocational interest patterning. He found "...that the relative contribution of ability to interest patterning in late adolescence was greater than that of adjustment: and, that differential aspects of the interest profile were affected by ability and quality of adjustment."[31]

White investigated the predictive relationship of 29 variables to the vocational interest stability of high school students. "The predictor variables studied were Age, Father's Occupation, Work Experience, Farm Background, Parent Education Intelligence, scores made on each scale of the Furst interest test, and personality characteristics as measured by the Minnesota Counseling Inventory. Each of the 10 scales of the Kuder Preference Record, each of the 7 clinical scales of the MCI, and each of 7 occupational categories were regarded as separate variables. He found no significant difference between pre and posttest means for boys when using the 29 variables to predict interest change. In testing the significance of each variable White found that "...Computational ability was significant at the 1% level and Intelligence at the 5% level. He "...concluded that statistically significant predictive relationships existed between certain variables and amount of interest change over two school years, but that these relationships were of limited utility for purposes of individual prediction."[32]

31 John O. Crites. "Ability and Adjustment as Determinants of Vocational Interest Patterning in Late Adolescence." (Unpublished doctoral dissertation, Columbia University, 1957).

32 Robert H. White. "The Predictive Relationship of Selected Variables to the Vocational Interest Stability of High School Students." (Unpublished doctoral dissertation, University of Minnesota, 1958).

Samuelson investigated the relationship between Kuder Preference Record interest scores and success in vocational areas. He found that students scored highest on the Mechanical scale, but that the scale was "...correlated with the criterion of student success to only a negligible degree. The Scientific, Persuasive, and Literary scales were correlated with the criterion beyond the 1 per cent level of confidence and may represent a pattern of interests that would be useful in predicting success in trade school training." However, Samuelson reports low correlation coefficients between the scales and the criterion and concludes that "...these relationships seem to be of limited usefulness for predictive purposes."[33]

Motto studied the relationship between the Kuder Preference Record scales and teacher judgment of student performance in vocational areas. The students involved in the study were attending Michigan Veterans Vocational School. He found that "none of the Kuder Preference Record scales significantly differentiated successful from unsuccessful vocational school trainees..."[34]

Garrett investigated a college population to compare the predictive power of the Kuder Preference Record and the Strong Vocational Interest Blank. He found that the use of the KPR or the SVIB did not sifnificantly affect the ability of college counselors to predict occupational placement.

33 Cecil O. Samuelson. "Interest Scores in Predicting the Success of Trade School Student," Personnel and Guidance Journal, 36:538-41, April, 1958.

34 J. J. Motto. "Interest Scores in Predicting Success in Vocational School Programs, "Personnel and Guidance Journal, 37:674-6 May, 1959.

He also reports that the addition of the interest tests did not improve the accuracy of predictions based on a background of interview information, personal data, and other tests.[35]

Gordon and Anderson studied certain skilled occupations in an attempt to identify vocational interest factors associated with each trade area. They found that the interest factor for electrical and electronic areas were not separate factors. Mechanical and construction areas were also indentified as having one interest factor rather than separate factors.[36]

Barnette and McCall investigated the usefulness of the Minnesota Vocational Interest Inventory as a selection and counseling instrument in vocational high school. The major vocational areas were building, electrical, food service, machinist, mechanical, and printing trades. He found that negro students earned "...lower average scores than whites on all the ability measures save one (the DAT Abstract Reasoning), a test frequently regarded as lacking 'academic' content." Barnette and McCall conclude that the MVII can be used successfully by guidance counselors in selecting students in the vocational areas of printing and to a lesser degree in the electrical areas. In the vocational areas of building trades, machinists, mechanics,

35 Gene A. Garrett. "A Comparison of the Predictive Power of the Kuder Preference Record and the Strong Vocational Interest Blank in a Counseling Setting." (Unpublished doctoral dissertation, University of Missouri, 1961).

36 L.V. Gordon and A.V. Anderson. "Factor Analysis of Interests in Certain Skilled Occupations," Educational and Psychological Measurement." 22:473-83, Autumn, 1962.

and welders the MVII was not effective in identifying student trade interests.

Silverman studied the role of occupational interests in differentiating between eight different trade and technical training programs at the high school and post-high school level. He used the Hackman-Gaither Vocational Interest Inventory. The students were selected from the vocational areas of commercial, cosmetology, practical nursing, professional nursing, agriculture, automotive, drafting, and electronics. He found that there were significant differences between academic and trade and technical students and also among all trade and technical groups. Silverman established separate empirical keys which "...were found to be superior for differentiating among students enrolled in the various trade and technical curricula..."[38]

Buchalew and Hackman investigated the relationships among intelligence, interest and personality and their importance in counseling an eighth grade student. Personality was measured by the California Mental Health Analysis, Intermediate Series. Interest was measured by the Kuder Preference Record, Vocational Form CH, and the Temple Vocational Inventory. Intelligence was measured by the California Test of Mental Maturity. They found no evidence of relationships between personality and interests. "However", the investigators state, "there may be merit to the rather common belief in our society

37 W.J. Barnette, Jr. and J.N. McCall. "Validation of the Minnesota Vocational Interest Inventory for Vocational High School Boys." Journal of Applied Psychology, 48:378-82, December, 1964.

38 Edward Henry Silverman. "An Investigation of Certain Occupational Interests of 1600 Students Enrolled in Eight Selected Vocational and Technical Training Programs Not Requiring a College Degree." (Unpublished doctoral dissertation, Temple University, 1964).

that people in various occupations tend to have personalities in keeping with their occupations, when the belief is applied to mature adults." (Italics in the original). The interest inventory was determined to be "...helpful in advising on both vocational areas to prepare for and to avoid..." The personality inventory, it was advised, should not be used alone by counselors for vocational guidance, but rather, as a device "...to detect those who may need psychological or psychiatric help." Intelligence, it was found, was related to some vocational interest area, but the investigators emphasize that the guidance counselor "...should not assume that high or low intelligence of an individual student would eliminate or select fields of vocational interest."[39]

Furst studied the use of a self-rating scale on eighth and ninth grade students as a predictor of academic achievement. He used the Stern activities Index, the preference a student expressed for academic and nonacademic subjects and verbal and nonverbal measures of general ability. Furst concluded "...that a simple, objective, and fairly direct self-rating scale of motivation to do well in school tends to give better predictions than more generalized measures of need to achieve or measures of intrinsic intellectual interests."[40]

Lowman investigated certain characteristics of disadvantaged youths and their relationship to success in selected Manpower Development Training

39 R. J. Buchalew and R. B. Hackman. "This is Educational Research: Vocational Interest Areas Related to Personality and Intelligence." Pennsylvania Scholastic Journal, 114:371-3, April, 1966.

40 E. J. Furst. "Validity of Some Objective Scales of Motivation for Predicting Academic Achievement," Educational and Psychological Measurement, 26:927-33, Winter, 1966.

Act curriculums. He used the Index of Adjustment and Values, the Index of Value Orientations, and the Minnesota Vocational Interest Inventory to gather data. Lowman reports that "relationships among initial measures of self-others concepts, vocational interests, and socio-economic status were not found to be statistically significant..." These same relationships when compared with instructors' assessments of learning achievement and instructors' predictions of probable occupational success, based on personal characteristics were not statistically significant. Lowman "...concluded that the initial measures could not be used as predictors of probable occupational success, but that the evidence..." suggests the possibility of using initial measures as a basis for counseling and program design..."[41]

School Grades

Fleming studied the relationship of entering age, grades, and intelligence with student success in the vocational high school.

He suggests a formula to help improve the selection process for trade schools which includes former school teachers' marks in shopwork, former school teachers' marks in the combined subjects of English, science, and mathematics and scores on the Otis Self-Administering Intelligence Tests.

41 Clarence L. Lowman. "The Relationships Between Certain Characteristics of Enrollees and Measures of Their Success in Selected Manpower Development and Training Act Curriculums." (Unpublished doctoral dissertation, The Florida State University, 1967)

Fleming points out that teachers marks may be measuring more than academic achievement. It may be, he suggests, that the teachers' evaluation measures such things as habits of industry, initiative, dependability, accuracy, and other factors that are predictive of success in the vocational schools.[42]

Halsey investigated the predictive value of certain measures in selecting students for the technical curricula of community colleges. The technical curricula included construction, electrical, industrial chemistry and mechanical technologies. The investigator used the high school record, mathematics test results, seven of the Differential Aptitude Tests, and high school marks in his search for predictor variables. He found that the high school marks had the highest correlation coefficient (.52) with success at the end of the freshman year at college.[43]

Gwydir studied chronological age on entry, scores on the Differential Aptitude Test battery, high school mathematics average, high school science average, and overall high school average as predictors of success in a community college construction technology curriculum. He found that the high school mathematics average, score on the Numerical Ability Test of the D.A.T. battery, and the overall high school average were signififcant (.01)

42 Joseph W. Fleming. "Predicting Trade School Success." Industrial Arts and Vocational Education. October, November, December, January, February, April, Vol. 27, No. 8,9,10, 1938. Vol. 28, No. 1,2,3,4, 1939.

43 Hugh Halsey. "The Predictive Value of Certain Measures Used in Selecting Freshmen for the Technical Curricula in a Community College." (Unpublished doctoral dissertation, New York University, 1956).

variables for predicting success.[44]

Long investigated the relationships between various junior high school data and subject marks in an attempt to devise a method of predicting success in five technical-vocational high school areas. The "...data included the grade averages in language arts, mathematics, social studies, science, industrial arts and home economics, as well as the standardized test scores from the California Reading Test for reading vocabulary and reading comprehension and I.Q. test scores from the Otis Quick-Scoring Test of Mental Ability and the Science Research Associates Primary Mental Abilities Test." Long reports multiple R's of .38 for industrial arts to .64 for science when using the eight predictors. He found three predictors as effective as the eight. The best over-all predictor, Long states, "...was the grade point average in junior high mathematics. Junior high social studies grade point average contributed significantly for boys..." Reading vocabulary scores were not effective predictors,"...whereas reading comprehension scores constituted one of the best predictors."[45]

Dubrow explored the "...relationships between vocational readiness and (1) Age within the same grade, (2) Intelligence, (3) Socioeconomic status

44 Robert R. Gwydir, Jr. "Predicting the Success of Students in the Construction Technology Curriculum at the New York City Community College of Applied Arts and Sciences." (Unpublished doctoral dissertation, New York University, 1957)

45 James R. Long. "Academic Forecasting in the Technical-Vocational High School Subjects at West Seattle High School." (Unpublished doctoral dissertation, University of Washington, 1957)

of the family, (4) Level of preferred occupation, (5) School grades, (6) School grades as determined by factors other than intelligence, (7) Primary interest pattern on the Strong Vocational Interest Blank (VIB), (8) Interest Maturity scores on the Strong VIB, and (9) Occupational Level scores on the Strong VIB." Dubrow found significant (.05) "...relationships between vocational readiness and factors (1) Intelligence, (2) Socio-economic status of the family, (3) Level of preferred occupation, (4) School grades, and (5) School grades with intelligence held constant."[46]

Whitten investigated the validity of selected criteria for admission to vocational high school. The 873 students studied were enrolled in courses in automobile mechanics, carpentry, commercial art, cosmetology, dressmaking, dry cleaning, electrical construction, food preparation, machine shop, painting, radio, shoe repairing, tailoring, trowel and welding.

From the group of 873 studied. "...303 graduated, 372 withdrew after completing one or more semesters, and 198 failed to complete a semester." He found that:

> For the 675 enrolees who completed one or more semesters, the variables that had significant correlations with vocational school achievement were intelligence (.253), reading (.268), industrial arts or home economics (.281), ninth grade science (.285), ninth grade mathematics (.291), ninth grade English (.301), ninth grade attendance (.303), arithmetic (.312), ninth grade social studies (.341), and

46 Max Dubrow. "Factors Related to the Vocational Readiness of Adolescent Boys." (Unpublished doctoral dissertation, Columbia University, 1959).

> ninth grade academic average (.367). The multiple correlation coefficient for vocational school achievement was .495. Variables that contributed to the correlation at the 1 per cent level were industrial arts or home economics, ninth grade attendance, intelligence, arithmetic and ninth grade social studies. Ninth grade attendance was the best predictor of persistence and graduation, and also showed a marked relationship to achievement.

Whitten found that selecting students on the basis of the multiple variables had a small advantage in identifying those who achieved best. He also found that students selected on the basis of attendance were those who attended longest and represented the majority of those students who graduated. Whitten recommended that the criteria for admission to vocational high school be ninth grade attendance and, or the variables that were significant in the multiple correlation.[47]

Livers studied "...the usefulness of selected student characteristics from the high school record in predicting success in specific business, trade, and technical schools and in later vocational success." He found that "grade point average and rank in class are the most consistent single predictors of performance in business, trade and technical school training." He also states that "academic factors are by and large the most useful variables for predicting performance in specialty school training when multiple regression procedures are employed." Livers points out that school success

47 Benjamin C. Whitten. "An Investigation of the Validity of Selected Criteria for Admission to a Vocational High School". (Unpublished doctoral dissertation, The Pennsylvania State University, 1961).

can be predicted better than job success following training.[48]

Lo Cascio examined the role of vocational preference as related to ninth grade vocational maturity and three achievement variables. Intelligence, parental occupational level, cultural stimulation, school curriculum, and school achievement "...were found to be positively related to vocational preference implementation." Vocational maturity, "participation in school activities, achievement vs. underachievement, and agreement of levels of occupational aspiration and expectation were not related to vocational preference implementation." Lo Cascio report that "the fact that five of the eight correlates of vocational maturity in the ninth grade were possitively related to vocational preference implementation, a presumed measure of vocational maturity after high school, suggests that these ninth grade variables have predictive as well as concurrent validity."[49]

Millet assessed the achievement of high school graduates and dropouts in Alabama vocational schools. Although his study did not deal specifically with predicting success in vocational aresa, he did report as a related finding "...that high school standing is not an efficient predictor of success in the vocational school.[50]

48 David L. Livers, Jr. "A Study of Relationships Between Selected Student Characteristics and Educational-Vocational Success of Students Attending Trade, Technical and Business Schools." (Unpublished doctoral dissertation, State University of Iowa, 1963).

49 Ralph Lo Cascio. "A Study of Vocational Preference Implementation," (Unpublished doctoral dissertation, Columbia University, 1965).

50 Garland J. Millett. "Achievement of Male High School Dropouts and Graduate in Alabama Vocational Schools." (Unpublished doctoral dissertation, George Peabody College for Teachers, 1965).

Yung studied graduates of day-trade auto mechanics and related occupations to determine whether selected psychological traits and environmental factors could play a role in selecting students for these fields. "The psychological traits identified included: (1) mental ability, (2) mechanical aptitude, and (3) academic achievement as measured by grades received in selected school subjects. The environmental factors identified included: (1) education level of parents, (2) father's occupation, (3) school attendance record, (4) work experiences, and (5) avocational interests." Yung found a significant difference between those students who were employed as auto mechanics and those who were not on, "...(1) grades received in ninth grade science, and (2) the distribution of fathers among the various occupational categories."

He reported that those students enrolling in the course with a desire to seek employment in the field of auto mechanics tended to accept employment in this field while those enrolling because they wanted to learn to repair their own automobile tended to reject auto mechanics as an occupation. He also reports that friends and family had little influence on the students decision to enroll in the auto mechanics program.[51]

[51] John C. Yung. "An Analysis of Graduates of Day-Trade Auto Mechanics Programs in Missouri in Terms of Selected Psychological Traits and Environmental Factors With Implications for Selection." (Unpublished doctoral dissertation, University of Missouri, 1965).

Structured Interview

Hovland and Wonderlic developed and tested the Diagnostic Interviewer's Guide which combined a Standardized interview and an interviewer rating sheet. The D.I.G. covers the applicants work history, family history, social history and personal history. They found that the higher an applicant scored on the D.I.G. at the time of employment the better were his chances of succeeding on the job.[52]

Worpell studied five tests and high school grades for their potential value as instruments for predicting the success of machine shop trainees. The five tests were a Survey of Object Visualization, a Survey of Mechanical Insight, the Thurstone Temperament Schedule, a Reading Comprehension Test, and a Mathematics Test. He found "...that these five tests and high school grades produced a multiple correlation with the criterion (shop classroom grades), of .69 $\pm$ .06. Worpell concluded that by replacing the Thurstone Temperament Schedule and the Survey of Mechanical Insight with a patterned interview and a careful examination of information obtained on the application blank "...a reasonably good selection of new trainees could be accomplished..."[53]

Racky investigated the use of aptitude and interest measures as predic-

52 Carl I. Hovland and E. F. Wonderlic. "Prediction of Industrial Success from a Standardized Interview." The Journal of Applied Psychology, Vol. 23, 1939 pp. 537-546

53 Donald F. Worpell. "A Study of Selection Factors and the Development of Objective Criteria for Measuring Success in a Co-operative General Machine Shop Training Program" (Unpublished doctoral dissertation, University of Michigan, 1956).

tors of success in ninth grade woodshop. The variables used were "...the Kuhlmann-Anderson intelligence Test H, the S.R.A. Primary Mental Abilities Test AH, Ages 11 to 17; the MacQuarrie Test for Mechanical Ability, the S.R.A. Mechanical Aptitude Test AH; the Kuder Preference Record-Vocational Form CH, and the Garretson and Symonds Interest Questionnaire for High School Students." The pupils' age and a "personal data questionnaire" were also used as variables. Racky concluded that "...the Personal Data Questionnaire and mechanical aptitude as measured by the MacQuarrie Test of Mechanical Ability have a greater influence on woodshop grades than any of the other factors measured." He also reports that interests as measured by the Garretson Interest Questionnaire or by the Kuder Preference mechanical area, mental ability as measured by the S.R.A. Primary Mental Abilities Test of the Kuhlmann-Anderson Intelligence Test, and mechanical aptitude as measured by the S.R.A. Mechanical Aptitude Test have a definite significant relationship to the grades..."[54]

Lane used a Vocational Questionnaire and the Kuder Preference Record in an attempt to identify the successful college student. In predicting subsequent academic status, Lane found that on the basis of individual interest scores, he could predict the eventual academic status of approximately three out of four students.[55]

[54] D. J. Racky. "Predictions of Ninth Grade Woodshop Performance from Aptitude and Interest Measures," Educational and Psychological Measurement, 19 n. 4:629:636, Winter, 1959.

[55] Paul A. Lane. "The Relationship Among Some Measures of Preferred Interest, Vocational Objectives and Academic Performance." (Unpublished doctoral dissertation, The University of Connecticut, 1959).

Dayton, Mitchell and Uhl investigated the applicability of the Vocational Planning Interview Scales to 9 - 12 grade high school students. They found that through the use of factor analytical techniques the VPI scales were able to differentiate among six types of high school students: (1) realistic, (2) intellectual, (3) social, (4) conventional, (5) enterprising and, (6) artistic. The investigators report that "The evidence lends credence to the hypothesis that a student's VPI personality type is related to his success in school. In terms of grade level comparisons, the VPI provides a useful, nonOintellective predictor of achievement..." They also discovered that the VPI type of a student was as efficient as teachers' ratings in predicting classroom achievement. High social and intellectual scale scores, with low Realistic and Artistic scale scores from the VPI was also found to be predictive of high classroom achievement.[56]

Holland and Lutz studied the predictive value of a student's report of his vocational choice and role as compared with his scores on the Vocational Preference Inventory. They found that the prediction of a student's later vocational choice was made most effectively by one of two methods "...(1) ask the student about his first two vocational choices, or (2) ask him once about his vocational intentions and then ask him for his preferred vocational role." The investigators report that "Either of these methods is almost twice as

[56] Mitchell C. Dayton and Norman P. Uhl. "Relationship Between Holland Vocational Inventory Scores and Performance Measures of High School Students." University of Maryland, Emory University, August, 1966.

efficient as the Vocational Preference Inventory." They suggest that it may be constructive to utilize the student's vocational choice and history rather than rely upon interest inventories in placing vocational students.[57]

Industrial Arts Teachers Ratings

Moss studied the effect of industrial arts experience on grades earned in post-high school trade and technical curriculums in automotive, drafting, electrical, and machine shop areas.

He attempted to determine whether industrial arts provided a valuable pre-vocational experience for those students interested in studying post high school trade and technical education. He found that "no difference in scholastic achievement could be attributed to differences in the amount of seniors high school industrial arts experience, or absence of this experience, grades in industrial arts, or differences in content or objectives of industrial arts classes." He also found that high school academic courses, particularly physical science courses, were as effective as industrial arts in preparing students for trade and technical curriculums. He suggests that

57 John L. Holland and Sandra W. Lutz. "Predicting a Student's Vocational Choice." Iowa: American College Testing Program, March, 1967.

on the basis of his study there is serious question about the pre-vocational value of industrial arts.[58]

Miscellaneous

Brown developed a Mechanical Performance Test to assist in the selection of students for jobs requiring mechanical performance. His test consisted "...of four sub-tests: Peg Boards; Hub Assemblies; Spatial Relations; and Gadget Assemblies." The gorups he studied included loom fixers; warp and smash hands; auto mechanics; auto mechanic shop students; machine shop students; and drafting students. Brown reports that "in every case, one or more of the sub-tests correlated significantly with the criterion." "From these results," Brown concludes, "it appears that performance on some of the sub-tests is related to performance on some jobs and shop courses." "...The results are significant enough to suggest possible predictive validity in some situations.[59]

Johnson examined the selection process in apprenticeship programs in

58 Jerome Moss, Jr. "The Influence of Industrial Arts Experience on Grades Earned in Post-High School Trade and Technical Curriculums." Cooperating Research Project No. 2050, Minnesota Research Coordination Unit in Occupational Education, University of Minnesota, 1966.

59 Robert L. Brown. "The Development and Validation of a Mechanical Performance Test." (Unpublished doctoral dissertation, Purdue University, 1957).

Illinois and its relationship to apprentice completion rate. He found that the majority of the selection officials preferred that the apprentices have high school vocational training. Five traits, sense of responsibility, industriousness, self-confidence, cooperativeness, and honesty were considered to be important for probable success in apprentice programs. Mechanical abilities and mathematical abilities were considered the two most important abilities that an apprentice should possess. Johnson also reports that "generally, there were few differences in the percentages of apprentices completing training in the programs in which selection officials used employment tests, interviews and personal references in selecting apprentices, than in those programs in which those devices were not used.[60]

Hagemeyer studied selection practices for apprentices in manufacturing companies in Michigan. He found that manipulative skills, hobbies, high school recommendations, previous employees' recommendations, and high school graduation were considered important assets for an apprenticeship applicant.[61]

Baldwin has planned a study of the auditory sense and its relationship to diagnostic ability in the areas of auto mechanics, machine shop, radio-TV repair, and air conditioning-refrigeration. The primary objective of the study is to determine whether students ability to use the auditory sense to

60 Marvin E. Johnson. "Practices in the Selection of Apprentices for Training and Their Relation to the Completion Rate." (Unpublished doctoral dissertation, University of Missouri, 1959).

61 Richard H. Hagemeyer. "An Investigation of Factors Considered in the Selection of Apprentices by Manufacturing Companies in Michigan." (Unpublished doctoral dissertation, Wayne State University, 1961).

distinguish certain diagnostic sounds differentiates between successful and unsuccessful students. The investigator will also determine whether this differentiation is independent of that made by paper and pencil tests. High fidelity recordings will be made of sounds which are thought to be useful in doing diagnostic work. In auto mechanics, for examples, a series of 50 to 100 sounds of malfunctioning parts of an automobile will be produced. Four possible causes of the sounds will be presented to the student. The task of the student will be to choose the correct cause of the malfunction. The investigators will obtain correlations between the auditory sense test and paper and pencil tests to determine the extent to which this test measures independent dimensions of achievement.[62]

Lofquist and others developed a "Theory of Work Adjustment" to provide a conceptual framework to interpret, to organize, and to integreate research results. Their system for predicting the outcome of vocational counseling is concerned with a number of basic concepts. Correspondence, which is described "...in terms of the individual fulfilling the requirements of the work environment, and the work environment fulfilling the requirements of the individual. Work adjustment, which is "The continuous and dynamic process by which the individual seeks to achieve and maintain correspondence

62
Thomas S. Baldwin. "The Development of Achievement Measures for Trade and Technical Education. Progress Report Number Three." North Carolina University, November, 1966.

with his work environment..." Tenure, described as the "Stability of the correspondence between the individual and the work environment..." Satisfactoriness and satisfaction, which are identified as "...the correspondence between the individual and his work environment." With the conceptual framework established the investigators searched for instruments to supply the relevant data necessary to provide the vocational counselor with information to assist in identifying those jobs and job families that are "possible" for an individual student in work-adjustment terms. The investigators identify the General Aptitude Test Battery and the Occupational Ability Patterns as instruments to gather data on individual correspondence or the abilities and the ability requirements of jobs. They developed the Minnesota Importance Questionnaire to describe the work relevant needs of individuals, that is work adjustment. The measure of tenure did, obviously, not require a test. The Minnesota Satisfaction Questionnaire and the Minnesota Satisfactoriness Scales were also developed by the investigators. With these instruments the investigators report that the vocational counselor should be able to narrow expertly the number of possible job choices that will most likely result in success.[63]

At Harvard University a project is underway to determine the value of various aspects of a computer-based information system in the overall guidance of students toward wise selecting and decision making in relation to

63 Lloyd H. Lofquist. "A System for Predicting Outcomes of Vocational Counseling." Paper presented at the American Psychological Association Convention, Washington, D. C., September 5, 1967.

educational and occupational choices. A wide range of variables to be used to assist the student in making these choices are being compiled. Procedures used in this study would indicate the possible use of the data being gathered in selection and guidance procedures at the secondary and post secondary levels. The project has been conducted over a two year period and is continuing. This project will be reported in greater detail in a later section of this study.[64]

64 Harvard Graduate School of Education. "Information System for Vocational Decisions." Annual Reports 1966-67, 1967-68.

RESEARCH DESIGN DEVELOPMENT

The development of the research design for this study began during the early planning of the study as a continuation of the Connecticut Vocational Study which concerned itself with the use of battery standardized tests as predictive instruments.

Planning

Preliminary thinking in reference to the design to be followed in the continuation of the study was expressed in the following statement from a letter from the New York State Department of Education:

> ...after a discussion ...concerning the study's implementation, the question of revision of the aptitude test battery or perhaps even modifying our approach to the solution of the problem; namely, the screening of students for secondary vocational-industrial education programs might come up as a point of discussion.

In July, 1967 representatives of the New York State Department of Education, Division of Occupational Education and the Division of Occupational Education Research, The Connecticut Vocational (Predictive Testing) Study, and of the Office of Research and Field Services of New York University discussed the possibility of changing the general emphasis of the study from prediction alone to the broader consideration of the selection of students for trade programs in public secondary schools.

The results of this and subsequent meetings with those concerned with the study were expressed in the following summarizing statements from a

letter from the New York State Department of Education:

> ...it would seem that our overall objectives of developing instruments and techniques for more effective student selection has not changed. Rather it appears as if our emphasis is now on: (a) a factor analysis of identifiable elements, common to success in high school trade and industrial education; and (b) the development of measurement instruments which may be used by counselors prior to student entrance into vocational education.
>
> Knowing full well that more than a single calendar year will be necessary to carry out the final stages to completion, we suggest that your redeveloped design incorporate the following stages:
>
> I. Conduct an in-depth workshop seminar with experts in the field of secondary trade and industrial education in order to establish criteria for "student success" and to obtain suggestions for effective methodology in directing the project design.
>
> II. A complete and comprehensive review of literature dealing with prediction of student vocational success, exploring such elements as learning factors, behavioral factors, status-role factors, conceptual factors, and any other areas deemed significant by the investigator.
>
> III. Utilizing the results of stages 1 and 2, develop a design in methodology for conducting a pilot study in New York State Schools.
>
> IV. To carry out stage. III.
>
> V. To refine measurement instruments and techniques, analyze results obtained from the pilot, and apply these revisions in an interstate study.

The suggestions outlined above were carried out in the final development of the proposal for the study and in the development of a plan of procedures to be followed.

Review of Research and Literature

A complete and comprehensive review of research and literature dealing with prediction of student vocational success and exploring such elements as learning factors, behavioral factors, status-role factors, conceptual factors, and other factors related to success in vocational training was undertaken for the purpose of gathering information relative to selection and prediction, and of determining procedures which might contribute to the design of this study. This review was continued throughout this phase of the study to the time of its completion.

In Depth Workshop Seminar

In April 1968, meetings of experts in the field of secondary, trade, and industrial education were conducted for the purpose of establishing criteria for "student success" and of obtaining other suggestions for this study.

Meetings were opened with an explanation of the purpose of the study and an overview of related research and literature. Participants were asked to contribute to the development of the research design by suggesting procedures for the prediction of success, the selection of students for trade training programs, and the nature of instruments which might be used in the guidance of students in relation to trade training.

It was also pointed out that the purpose of the study was one of developing a predictive instrument or instruments which may be used effectively with ease of administration and efficiency. A questionnaire (pg. A-3) which

requested views on prediction, instrument content, format, and administration for the purpose of gaining information which might lead to the development of a broad comprehensive and workable tool for use in pupil placement was submitted to those present. It was also submitted to other representative teachers and administrators in trade training programs from various areas of the state. The results are presented in Table I. A total of sixty-one vocational educators responded. Some respondents did not make any choice or suggestion on some items while others made more than one choice or suggestion.

The information gained through the use of the questionnaire was used, in addition to other information gathered in establishing a framework for the development of instruments for this study.

Because of the orginal plan to involve teachers, supervisors, and administrators in the planning of the research design an "action research" approach was used throughout the study.

The joint meeting of supervisors and administrators was summarized in the following report:

> At a preliminary joint meeting of supervisors and administrators of trade programs, guidelines were suggested for the development of a predictive instrument to measure future success in vocational education.
>
> The purpose of the predictive instrument developed, the committee thought, must be consistent with the philosophy of the New York State Education Department in providing every student, regardless of his level of ability, with an equal opportunity to participate in a vocational education program.
>
> There was a concern expressed that many selection procedures eliminate students who might be successful vocational students. The feeling prevailed that the instrument developed must not select or exclude, but rather, guide the vocationally oriented student to areas where his chances of success are greatest.

TABLE I

SUGGESTIONS FOR SELECTION AND PREDICTION INSTRUMENT CONTENT AND DESIGN

61 Respondents

	Number
Instrument Content	
Knowledges to be Tested	
Mathematics	39
Science	33
Reading Comprehension	9
Spacial Relations	6
Knowledge of Tools	6
Aptitudes to be Tested	
Mechanical Ability	21
Manual Dexterity	18
Science	12
Mathematics	12
Spacial Relations	9
Abstract Thinking	3
Interests to be Discovered	
Occupational Choice	18
Trade Interest	15
Mechanical Interests	12
Science	9
Hobbies	9
Art	6
Instrument Design - Reading Level	
Instruments should be Designed for	
Non Graders	6
Grade 4	3
5	0
6	9
7	33
8	3
9	9
Instrument Design - Grade Level	
Instruments should be Designed for	
Grade 7	3
8	21
9	21
10	6
Flexibility - Any Grade	3
Instrument Design - Time: Total Battery	
1 Hour	6
2 Hours	3
3 "	15
4 "	0
5 "	6
6 "	0
7 "	3
As much time as needed	6
Instrument Design - Time: Single Sittings	
20-30 Minutes	12
30-40 "	18
40-60 "	9

Some members of the committee noticed a recent decrease in the dependance on tests and testing programs as a determinant for student placement. One reason given for this decrease was the lack of information for reliably predicting the success of vocational students.

The information provided by a predictive instrument will fill a present informational gap and, through the guidance personnel, will provide the student with a more realistic evaluation of his chances of success in vocational areas.

A discussion of the format of the predictive instrument to be developed resulted in an agreement that the instrument should consist of two basic elements. The first element should be a structured interview and the second, a battery of tests. In the test battery the items should be constructed to provide for student multiple-choice by check rather than by written response.

There was discussion on the usefulness of the specific trade area predictive test as opposed to a general predictive instrument. There was agreement that the general predictive instrument would be of greater value to vocational education. The group suggested that the instrument be scaled so that the student moves from easy to more difficult items. This technique, it was felt, would avoid student discouragement, and would offer the possibility of establishing predictive cut-off scores for many vocational areas.

The structured interview should be administered by a guidance counselor. The battery of tests should be designed to be flexible enough to be administered to an individual or any size group. The tests should be constructed so that they can be given one by one in the regular class periods or as a complete battery which would require a maximum time limit of three (3) hours. Adequate time should be provided for instructions. The instructions should be clear and complete enough so that the teacher, as well as the guidance counselor, can give the tests.

In discussing the content of the predictive instrument, there was agreement that not student should be put at a disadvantage because of the make-up of the predictive instrument. The reading level of the students taking the test must be considered rather than age and grade when the tests are constructed. The possibility of utilizing previous testing programs given in earlier grades should be investigated to cut down on testing time and to avoid duplication. Standardized tests, such as those used in the Connecticut Study which have demonstrated their usefulness in predicting vocational success should be investigated

to determine whether or not they can be utilized in this study.

The following areas were suggested for possible inclusion in the content of the predictive instrument:

1. The structured interview.
2. The intelligence test.
3. An interest inventory.
4. English reading, science and mathematics scores.
5. The industrial arts teachers rating.
6. Aptitude tests such as space relations.
7. A test of manual dexterity.
8. A qualifying physical examination.
9. Pupil attendance.

Report submitted by Dr. Gordon Campbell, Huntington Public Schools, Huntington, Long Island, N.Y. April 9, 1968.

The meeting of teachers of trade subjects was summarized in the following report:

At a preliminary meeting of teachers of trade subjects guidelines were suggested for the development of predictive instruments to measure future success in vocational education.

The committee felt a need for such instruments to ensure that each student is placed in a vocational area where his probability of success would be greatest. Too often, it was felt, the overflow of applicants in any vocational area is placed where there happens to be room, with little consideration of the student's chances of success. It was felt that the guidance counselor does the best he can, but generally places the student through guesswork rather than on the basis of objective information. It was also felt that the guidance counselor would welcome a predictive instrument, or series of instruments, that would increase the chances of correctly placing the vocational student.

A discussion of the format of the predictive instruments to be developed resulted in an agreement that they should consist of four basic elements:

1. A checklist for industrial arts teachers
2. A structured interview
3. An interest inventory
4. A b[illegible]ry of tests

There was [illegible]nsiderable interest and discussion on the use of the industrial arts teacher ratings. There was agreement that, at present, the industrial arts teacher was the most

accurate, reliable source for predicting the success, or failure, of students who had first taken industrial arts courses before entering vocational education. There was consensus that to take advantage of this resource, a checklist should be developed so that the industrial arts teacher can quickly provide vocational guidance counselors with profiles of students applying for vocational education. It was pointed out that pupils who had not taken industrial arts, such as parochial school pupils, would be excluded from this evaluation.

There was agreement that a structured interview should be developed and utilized as a preliminary step in the testing procedure. The interview should be an objective instrument that can be administered by the guidance counselor or the teacher. It was suggested that an observational check of physical characteristics, which might limit a pupil's usefulness in a vocational area, be considered for possible inclusion in the structured interview.

There were ambivalent feelings about the use of an interest inventory. Some felt that an interest inventory could not be reliable when pupils may differ greatly in their exposure to vocational areas. However, there was agreement that the interest inventory could supply additional information to assist in predicting success. The student who has interests, hobbies for example, that are related to vocational education, such as a hobby that requires the use of tools, has an advantage over those who do not have similar interests. The pursuit of such a hobby can be regarded as an asset. However, the absence of such a hobby should not be considered a liability.

The battery of tests, the committee felt, should be designed to test the aptitudes, abilities and skills that are associated with success in vocational education. A discussion of developing specific vocational area tests as opposed to a general predictive test concluded with agreement that the general predictive instrument held more promise as a useful guidance tool. It was suggested that perhaps the criterion measure of success should first be developed from successful senior vocational students who can be carefully scrutinized for traits, abilities, and aptitudes that might be identified as common to successful students.

It was suggested that the test battery include aptitude tests such as:

1. Mechanical ability
2. Visualizing spatial relations
3. Numerical concepts
4. Reading comprehension
5. Science

The cumulative record, it was thought, should be utilized to provide information to replace or support the information gathered by the predictive instrument.

There was a feeling that there may be personality factors that differentiate between the successful vocational pupil and those who are not successful. Some factors that seem desirable, and which may have bearing on pupil success are:

1. Honesty
2. Neatness
3. Orderliness
4. Organization
5. Getting along with others
6. Ambition
7. Patience
8. Inquisitiveness
9. Perseverance

There was, however, an opposing view that personal characteristics may change drastically and should not be included in a predictive instrument. There was some feeling that the trade training in vocational areas may influence a change in personal habits and characteristics. There was no resolution of this difference of opinion.

There was agreement that emotionally disturbed pupils should not be enrolled in vocational areas and should be screened out before the predictive instrument is administered by the guidance counselor.

There was discussion on the usefulness of tests of manual dexterity items in the industrial arts teachers' checklist.

There was consensus that the predictive instrument to be developed be as short as possible to avoid pupil disinterest and frustration. Thirty to forty-five minutes was a suggested range for the length of a test.

There was agreement that the predictive instrument should be administered during the eighth or ninth grade. However, the contents of the instrument should be designed at a sixth grade reading level and should not in any case be higher than eighth grade.

The members of the committee agreed that a pilot program would be feasible and desirable to allow for refinement of the predictive instrument. It was suggested that the pilot program sample be large enough to allow for a substantial number of drop-outs.

Report submitted by Dr. Gordon Campbell, Huntington Public Schools, Huntington, Long Island, N.Y. April 9, 1968

A second consultant summarized the meetings with the following report of his reactions.

"On the first day when we met with the administrators, the impressions I got concerning their interests are as follows:

1. They felt that a structured and possibly quantified interview to assess interest and motivation would be a step forward in selection and placement of vocational students.

2. They consider the evaluation of a school record as a significant predictor of success.

3. They feel that predictive tests should be used in those areas not covered in the above two categories. In reference to the type of instrument, they indicated that:

    1. The reading level of the test should be 7th or 8th grade level.
    2. Tests should have flexibility and be able to be used in different situations and at different grade levels.
    3. Tests should be incorporated in the total counseling situation and not be used as exclusive predictors.
    4. It would be better to use standardized tests already in use and shown to be correlated with success in vocational education. If a new instrument is to be developed, it should cover areas not adequately measured by existing tests. Suggested in this area were interest and study habit evaluations.

The group of shop instructors who met on the second day agreed with the administrators in terms of the matter of some statistical prediction, importance of non-intellectual factors, measurement of "ambition," and the need of structured interviews for the assessment of non-intellectual factors. This group did identify the importance of industrial arts teachers' judgment and would like to see some check list that could be provided to industrial arts teachers which could improve their ability to make judgments about the success of students in vocational education programs.

Report submitted by Dr. Herbert Righthand, Chief, Bureau of Vocational Services, Connecticut State Department of Education, Hartford, Connecticut. April 19, 1968.

Summary of Workshop Recommendations

In summary, the recommendations of those attending the workshops and answering the questionnaire may be outlined in the following statements.

1. Selection procedures should be based on the principle of equal opportunity for all students to participate in a program of vocational education.
2. Selection instruments must not be used to exclude but to provide information for purposes of guidance and orientation. They should be used to assist the student in determining where his opportunities are greatest.
3. There is a need for a series of instruments to provide counselors with necessary objective information to insure each individual student success through careful placement.
4. Instruments should be designed for general prediction rather than for prediction in specific trade areas, and should provide broad profiles of students' characteristics.
5. Several different instruments and types of instruments should be used to gather various types of information and to provide a broad student profile. Student characteristics and interests as well as knowledge and skill should be evaluated.
6. Instruments should provide information relative to knowledges and skills in mathematics, sciences, reading comprehension, mechanical ability, and manual dexterity.

7. Instruments should be designed for 6th or 7th grade reading level and should be constructed with items progressing from simple to more difficult. Multiple choice question structure was preferred.
8. Instruments should be designed to be administered to individuals or small groups during regular class or short time periods.
9. An industrial arts check list should be developed to evaluate student mental, physical and social characteristics in a shop situation.
10. A structured interview procedure should be developed for counselor or teacher use in obtaining information relative to student interests.
11. Personality factors that may differentiate between successful and unsuccessful students should be investigated.
12. Criterion measures should be developed on the basis of characteristics, abilities and aptitudes of successful trade training students.
13. A pilot program should be conducted for the purpose of evaluating instruments developed for this study.
14. The realiability and validity of instruments should be determined after initial refinements.

Development of the Research Plan

After considering the results of previous research and the recommendations of those attending the workshop it was decided by the research team and consultants that the immediate study should concern itself with:

1. the continuation of an indepth study of related present research, reports of related research, a review of pertinent literature and practice relative to the use of standardized tests in prediction and selection,

2. the development of a structured interview form,

3. the development of an industrial arts check list,

4. a procedure for using school grades as guidance instruments, and

5. the experimental use of the resulting structured interview form and the industrial arts check list for the purpose of evaluating, making necessary revisions, and for the purpose of determining the validity of these forms.

PART II

INSTRUMENTS AND PROCEDURES USED IN STUDENT SELECTION

One of the primary objectives of this study was to locate, and, or develop instruments for the prediction of success of the prospective student of the trade training programs. An investigation of existing tests and experimental programs of selective and predictive testing was conducted through an examination of literature, personal visitation, correspondence and interview. These tests and programs were analyzed and examined with reference to their predictive value, scope, treatment of subject matter, format of test forms, reliability, validity and administrative efficiency. A search of the literature reported previously was undertaken to determine which standardized tests could be used as effective selection instruments or predictors of student success in trade training programs.

Standardized Tests as Predictors

The Differential Aptitude Test as a Predictor

The Differential Aptitude Tests have been widely used in studies concerned with student selection. The results of such studies have not produced a clearly defined pattern which might identify the total DAT battery or individual sub-tests as effective predictors. The sub-tests most often reported as useful or significant predictors of student success in vocational areas are the tests of Mechanical Reasoning and Space Relations. Conflicting reports such as that by Mendicino (1955)[1] who recommends the DAT of Mechanical Reasoning as an instrument counselors should use "....to select and reject students for the vocational machine shop curriculum" and Ewald (1961)[2] who reported that the DAT of Mechani-

[1] Mendicino, loc. cit.

[2] Ewald, loc. cit.

cal Reasoning was not highly effective in predicting success in vocational education, illustrate the problems involved in choosing the DAT in whole or in part as an effective predictor. Another problem inherent in the selection of an instrument seems to be that of choosing an instrument that meets specific requirements. The present study is concerned with an instrument, or instruments that will provide meaningful information for the selection of, or identification of, the student who may prove successful in the vocational areas of machine shop and electricity. Hall (1954)[3] reported that the mechanical and electrical trades are closely related on DAT scores and could represent a segment of a family of occupations. In contrast to Hall, Stroughton (1955)[4] warned that electrical and machine shops should not be considered as a group because of the difference in abilities required for success in these areas. Research results suggest that there is a question as to whether an instrument should be developed as a predictor of general vocational success or as a predictor of success in a specific area such as machine shop.

In a review of literature on predicting success in vocational areas Ghesellli and Brown (1951)[5] and Patterson (1956)[6] questioned the differential validity of aptitude test scores. However, Prediger, Waple and Nusbaum (1968)[7] in a review of more recent literature, 1954-1967, reported that "...the case for differential prediction is more favorable." In the vocational area there seems

3 Hall, loc. cit.

4 Stroughton, loc. cit.

5 Ghesellli and Brown, loc. cit.

6 C. H. Patterson, "Predicting Success in Trade and Vocational Courses: Review of the Literature". Educational and Psychological Measurement.

7 Prediger, Waple and Nusbaum, loc. cit.

to be increasing evidence that the specialized skills involved in such different areas as machine shop and electrical shop will require specialized instruments which clearly differentiate between those students who will be successful and those who will be unsuccessful in a specific area. The New York University study of predictive testing in the vocational-technical schools of Connecticut clearly demonstrated the differential effects of using tests battery to predict success in the areas of electricity and machine shop. In this study there seemed to be little relationship between the effectiveness of a sub-test in the battery used to identify a successful student in electricity and the effectiveness of the same sub-test in identifying a successful student in machine shop.

The variety of results of research relative to the use of standardized tests suggests that there may be a number of undefined variables such as maturity, grade level, age, interest, and personality characteristics which may play a role in predicting the successful vocational student.

In any case the reported results of the use of the Differential Aptitude Test was an effective predictor of vocational success are not conclusive.

The General Aptitude Test Battery

Probably the most extensive and sustained research on the subject of predicting occupational success has been conducted by the United States Employment Service in the development of the General Aptitude Test Battery. This battery consists of eight paper and pencil tests and four tests of dexterity for which composite norms have been developed in relation to a number of occupations. Original efforts in the development of GATB began in 1935, and have continued since. When the correlations between the GATB scores and measures of occupational success are carefully examined, it is apparent that few of the correlations

are high, many are low, and the rest are moderate.[8]

The GATB research is conducted by subjecting experienced practioners in a wide variety of jobs to the test battery and developing norms from the results. The job proficiency of the workers is determined by supervisor's ratings. These norms are then used in counseling persons who have made scores on the same tests, but who have had no experience in the occupation. Because of the modest validity of the tests, their use is restricted to well trained testing specialists in the Employment Service. The results are reportedly interpreted with caution, and recommendations for the choice of a specific occupation are made on the basis of various factors rather than test scores alone. The fact that reliable norms have been established for persons under 17 years of age, should be considered by those who seek to predict the occupational future of adolescent youth.

This technique requires that measures of job success by practicing workers be established. Two types of measures are possible: objective and subjective. Objective measures include measured work output, or the measurement of selected work samples. Subjectives criteria require the judgement of an observer or evaluator, such as a supervisor. GATB researchers believe that both objective and subjunctive criteria should be used. However, objective measures are difficult to apply in many instances, and in developing GATB norms, supervisory ratings of worker competence have been used in the majority of cases.

In the GATB research the assumption is made that an inexperienced, untrained individual having test scores similar to a "successful" experienced worker will be likely to become equally successful in the same occupation. This appears to be the basic assumption in all predictive measures

[8] United States Department of Labor, Manpower Administration, Bureau of Employment Security, Manual for the General Aptitude Test Battery, Section III, Development. Washington, D.C. 1968.

of occupational success. The validity of this inference is questionable. For one thing, subjective measures of job proficiency can be biased for any number of reasons, and the uncontrolled variables thus introduced are many. More importantly, it is possible that the test responses of the experienced worker are learned in the process of learning the job, and do not pre-exist in the worker prior to training and experience. Only elaborate longitudinal studies with relatively large samples of workers could throw light on this question. Few such studies have been made and the samples have been small. In these studies, also, it has been impossible to control many of the variables.

Of 385 selected occupations, predictive validity measurements have been made by longitudinal studies for only 62. For these, the median correlation coefficient is .45. Validity measurements for the remaining 323 occupations have been made by correlating the test scores of experienced workers with their own job proficiency as determined by supervisors' ratings. For these the median correlation coefficient is .40. Neither of these correlations is sufficiently high to justify placing much weight upon GATB scores in predicting future success in any occupation. This seems to be especially true when one considers the inherent weaknesses of the research techniques employed.

At the high school level, Samuelson (1956)[9], Tate (1965)[10], Traxler (1966)[11], and Ingersoll and Peters (1966)[12] reported the GATB as a useful predictor in some vocational areas.

Employee Aptitude Survey

The reports of Ruch (1960)[13], and Broe (1962)[14] indicate that some

[9] Samuelson, loc. cit.

[10] Tate, loc. cit.

[11] Traxler, loc. cit.

[12] Ingersoll and Peters, loc. cit.

[13] Ruch, loc. cit.

[14] Broe, loc. cit.

sub-tests of Employee Aptitude Survey have usefulness as predictors of success at the post-secondary level. The test battery is designed for ages 16 and over. For selection of vocational students it is doubtful that this test battery can be useful.

Other Standardized Tests

In addition to the DAT, the GATB and the EAS there have been numerous other standardized tests used as predictors of vocational success. They have been used individually and as sub-tests of predictive batteries. In general, tests of mechanical ability and space relations have been reported as the most useful predictors of success in vocational areas. The results, however, are not consistent enough to warrant any conclusions on their usefulness in this study.

Interest Inventories as Predictors

Interest inventories are widely used in counseling students and directing them to areas where their interests lie. However, the review of literature on the use of interest inventories such as Kuder Preference Record and the Strong Vocational Interest Blank in predicting student success in vocational areas have generally produced inconclusive results. Studies reported in Section 1 such as Cooper (1954)[15], Samuelson (1958)[16], Motto (1959)[17], and Lowman (1967)[18] suggest that at best the interest inventory has limited usefulness as a predictor of vocational success and at worst did not differentiate successful from unsuccessful vocational students. For the purposes of this study, that is, the identification of the prospective vocational student who will be successful in the machine shop and electrical areas, the interest inventory may not be useful. The predictive instrument used for selection pur-

[15] Cooper, loc. cit.

[16] Samuelson, loc. cit.

[17] Motto, loc. cit.

[18] Lowman, loc. cit.

poses would have to be administered at a grade level or age where the vocational interest of prospective students may not be well differentiated. The contacts with industrial arts teachers in the development and pilot study of an industrial arts teachers checklist seems to confirm this theory. When asked to identify a vocational area where a junior high school industrial arts student would be successful the response of the teacher indicated that the judgement was premature because of lack of exposure to industrial areas. It may be that interests in some students are not developed until they have been exposed to or perhaps enrolled in a vocational program.

School Grades as Predictors

The grade point average and individual subject grades have been investigated in numerous studies to evaluate their usefulness as predictors or vocational school success. The results have ranged from findings that the use of school grades is useful as a predictor of vocational school success, Levers (1963)[19], to findings "...that high school standing is not an efficient predictor of success in the vocational school," Millet (1965)[20]. Individual studies have been reported as predictors of vocational success. When studying the college-bound student, relatively high validity of College Board scores, school marks, and Regents scores in predicting college success may be misleading. It may be that all that is being measured here is actual, observed performance in an activity calling for exactly the same skills which must be applied in college. In other words, the predictions are made on the basis of a lengthy tryout period in which the behavior of the student has been observed and measured in a single, highly specialized task -- the learning of school

[19] Levers, loc. cit.

[20] Millet, loc. cit.

subject matter. Because college demands more of the same behavior, the predictive validity is high. The transferability of this technique, however, to the occupational field is very doubtful. Crawford (1966)[21] reports that intelligence and scholastic achievement tests, generally used in combination with grade point average to predict college success, are not the best predictors of success in vocational education. The results of the studies reviewed are inconclusive. In the present study, where the predictive instrument used will be administered to students in quite different situations, for example the students in rural and urban schools and widely differing schools serviced by the same area vocational school, the usefulness of school grades as a stable measurement on which to base predictions of vocational school success is questionable. It may be that high school grades are effective predictors of college success where the task of learning school subject matter is similar in nature to the students' high school experience. The vocational curriculum however seems to require a broader area of skills which the prospective student may not have experienced in the subject matter previously studied. The applicability of school grades without extensive structuring to the prediction of vocational school success seems doubtful.

The Structured Interview

On the basis of a search of related literature and research, it appears that the structured interview has received little attention as an instrument of prediction and selection. Dayton, Mitchell and Uhl (1966)[22] reported that the Vocational Planning Interview Scales can be utilized to predict high classroom achievement. Gribbons and Lohnes (1964)[23] report that the Voca-

[21] Crawford, loc. cit.

[22] Dayton, Mitchell and Uhl, loc. cit.

[23] Gribbons and Lohnes, loc. cit.

tional Planning Interview Scales can predict with some validity as early as the eighth grade the curriculum in which a student will be enrolled at the high school level. Holland and Lutz (1967)[24] found that a student's vocational choice can be determined more effectively by asking him about his first two vocational choices, or asking him once about this vocational intentions and then about his preferred vocational role, than by the use of the Vocational Preference Inventory.

The amount of experimental work reported is not sufficient to make a judgment on the use of the structured interview as a predictor of success in vocational education. This is an area that will require further experimental research.

Industrial Arts Teachers Ratings and Checklist

Vocational teachers at initial planning meetings for this study were optimistic about the value of the industrial arts teachers' rating, and identified the industrial arts teacher as their most valid source of information in predicting the success of prospective vocational students. A search of literature has revealed little research of this technique. It might be assumed that an appraisal of industrial arts grades as predictors of vocational success may give an indication of the usefulness of this technique. Fleming (1939)[25] suggested that the teachers' evaluation may include measures of habits of industry, initiative, dependability, accuracy, and other factors that are predictive of success in vocational areas. Long (1957)[26] found that mathematics, social studies and reading comprehension were more effective predictors than industrial arts grades. Whitten (1961)[27] had similar results while

[24] Holland and Lutz, loc. cit

[25] Fleming, loc. cit.

[26] Long, loc. cit.

[27] Whitten, loc. cit.

Moss (1966)[28] reported that industrial arts grades did not differentiate between successful and unsuccessful vocational education students.

The use of industrial arts check lists have been suggested in New York State syllabi over the past twenty years. Although its use was not mandatory it was suggested that the information provided would be of value to the teacher, guidance counselor, and principal in helping the pupil with his school progress, the improvement of his adjustment to life, and his placement in a job upon graduation or leaving school. Courses of study, such as the general woodwork syllabi, usually contained recommendations for the keeping and use of industrial arts record cards on which would be included two lists of criteria relative to the type of information which the industrial arts teacher should observe and record. These lists usually were concerned with behavior characteristics primarily associated with adjustment to industrial arts and items pertaining to general social behavior. Criteria for evaluating shop and social behavior were provided to indicate the type of criteria which would be developed.

More research in the use of an industrial arts rating checklist seems necessary to evaluate its usefulness as a predictive instrument. In the development of such an instrument the characteristics of the successful vocational student, as evaluated by vocational teachers, should be given considerable weight. These characteristics when judged by the industrial arts teacher may provide a profile, quite different from the student's grade in industrial arts, which may have predictive validity.

Selection Procedures Used in Educational Programs

In order to gather information relative to methods of student selection and the prediction of success in major secondary school trade training programs throughout the nation, each state department of education, and sixty-five major

[28] Moss, loc. cit.

cities representing each state (p. A-7) were requested by letter (p. A-8) and follow-up letter (p. A-9) to participate in this study by describing procedures being used in the selection of students for trade training programs in their secondary schools.

Several states referred letters they had received to major cities. Of the eighteen states responding directly, twelve reported that they had no state policy in reference to the selection of students for trade training programs. Seven reported that they were planning programs of selection and prediction or that they were making studies of their selection procedures.

In some states, such as Connecticut and Georgia, a statewide policy and procedure for the selection of students for training in state operated vocational schools was reported. On a statewide basis, however, most responses indicated that locally operated schools and school sustems employ their own selection procedures. It should be noted that the number of locally operated schools having vocational courses exceeds the number of state operated schools having such courses in each state. The selection of students on the basis of locally determined procedures was indicated by statements such as :

> Procedures vary throughout the State by community and by area schools. It is best that you correspond with individual schools for the details.[1]

and:

> The State...has done very little toward research in student personnel selection. We have, however, like many other states continued to proceed in student selection in Vocational Education rather blindly.
>
> Many approaches have been used...[2]

[1] Letter, University of the State of New York, Albany, New York, Edward A. Shattuck, Associate in Industrial Education, April 11, 1968.

[2] Letter, State of Indiana, Indianapolis, Indiana, Thomas G. Garrison, State Supervisor of Vocational Guidance, March 29, 1968.

Eight of the states responding indicated that they were using, planning to use, or cooperating with the United States Employment Commission in the establishment of norms, for, the General Aptitude Test Battery as a means to solving problems of student selection for trade training programs.

Many of the cities responding also indicated the use of the GATB either experimentally or in actual student selection.

Selection Procedures

Responses received from states and cities seemed to indicate the use of two general procedures for selecting students for programs of vocational education in public secondary schools.

The predominant method of planned selection indicated by responses was one in which several or a variety of instruments and subjective as well as objective information is used in guidance and in the selection process. This method was expressed by such statements as:

> At the secondary level, students starting at the 7th grade begin to build a self-appraisal folder which is kept through the 12th grade. In the folder is kept: test information, grades, courses taken, credits accumulated, extra curricular activities, and employment and work experience. With this information, students with the help of guidance counselors map out long-range plans and make course selections accordingly.[3]

and:

> Students' records, interest, and personal interview with guidance and vocational personnel is the screening process being used by most schools.[4]

and:

> Our guidance counselors work with parents, pupils and teachers to arrive at a decision relative to which pupils should pursue vocational education programs. Psychometric data, pupil and parent interest determine course selection.[5]

[3] Letter, Department of Education, State of Hawaii, Albert J. Feirer, Director, Vocational, Post High and Adult Education Branch, July 16, 1968.

[4] Letters, State Board of Education, Commonwealth of Virgina, George S. Orr, Assistant Supervisor, Vocational Education, March 25, 1968.

[5] Letter, Madison Public Schools, Madison, Wisconsin, Carl H. Waller, Assistant Superintendent. June 27, 1968.

and:

All students accepted at our center must have made a written application and must have been interviewed by a counselor from our center.

Acceptance is based on the following:

1. Local high school counselors recommendation
2. Test results (which would include any or all of the following - D.A.T., G.A.T.B., S.T.E.P., S.C.A.T., A.M.M., I.T.E.D.)
3. Attendance and discipline record
4. Impressions gained from interview[6]

In some cities, a detailed procedure has been established for the selection of students for trade training programs. A composite of these procedures was reported in the following description of the selection system used in the Akron Public Schools.

After appropriate vocational orientation has taken place in the ninth grade the students interested in attending vocational school fill out a formal application. Upon completion of the application and the personality checklist forms (both enclosed), they are returned to the counselor for completion. The counselor channels the personality form to a subject teacher most closely related to the applicants vocational choice.

Upon completion of the personality form by the teacher and the application form by the counselor (career counseling has taken place to varying degrees with each student) both forms are forwarded to the vocational guidance coordinator for processing.

A representative group of junior high counselors (4) and a counselor from each vocational school (2) assist the coordinator in processing the applications. Guidelines for selection include: past achievement, attendance, personal checklist, test scores, and teacher and counselor recommendation. Each application is studied carefully to try and determine if the applicant's request is commensurate with the total information on the submitted forms. The applications are ranked according to best qualified to least qualified, all information having been considered.

The coordinator is responsible for final selection and acceptance of students into the program. Questionable or marginal applications may require one or more of the following steps for additional consideration: phone call to the counselor, phone call to the parent or applicant, coordinator session with applicant at the junior high, or visitation to the vocational school by the applicant for vocational teacher and counselor observation, counseling and recommendation to the coordinator.

[6] Letter, Area Vocational-Technical Center, Oklahoma City, Oklahoma, Paul Simmons, Counselor, July 10, 1968.

Upon final selection of students by the coordinator a selection notice (enclosed) is sent to the parents home. The student is officially accepted upon signed receipt of the selection notice in the coordinator's office.

Selection and placement of students for the vocational program in Akron is an attempt at being humanistic, concerned, and realistic in method and approach in trying to work with each student in career development. Each applicant is given as much individual consideration as possible before being accepted or rejected.[7]

The San Antonio Independent School District reported that it had recently initiated a program of predictive testing for all junior high school students interested in enrolling in high school vocational classes.

The testing and screening procedures which are being used are as follows:

1. The General Aptitude Test Battery is administered to all junior high school students interested in high school vocational class placement.

2. The Kuder General Interest Inventory form E or the Brainard Occupational Preference Inventory are administered and their results studied.

3. Reading grade equivalency and mathematics grade equivalency rankings are studied. Usually students who are more than 2 years deficient in either reading or mathematics ranking are excluded from vocational classes until they have been placed in remedial classes to remove their deficiencies.

4. Intelligence, test scores and achievement obtained through the district's standardized test program are considered.

5. Classroom grades, teachers' comments, and counselor recommendations are also considered.

6. Personal interviews are conducted with each prospective vocational class student. At this interview, test and inventory results are discussed with the student, along with his life goals and career plans.

The Office of the Vocational Counselor is responsible for administering and interpreting the results of the aptitude tests. Reading and Mathematics grade equivalency rankings, intelligence test scores and achievement test scores, interest inventory results, and classroom grades are obtained from the students' permanent record cards. The Office of the Vocational Counselor makes recommendations about the vocational classes for which each tested student is qualified and these recommendations are

[7] Letter, Akron Public Schools, Akron, Ohio, Robert Hughey, Coordinator of Vocational Guidance, July 3, 1968.

then turned over to the counselor of the prospective student. Though recommendations are made the actual placement of the student is the sole responsibility of the school counselor.[8]

Reports seemed to indicate that a different standard of selection was applied to those students seeking admission to vocational-technical programs in specialized vocational or trade training schools, to that applied to students who apply for admission to vocational courses in general comprehensive or academic high schools having vocational courses, even though courses elected by students may be the same in each type of school.

This difference is illustrated by the following statement:

> We have two Vocational-Technical High Schools in Portland - one for boys and one for girls. Considerations for selection of students are:
>
> 1. Interest of student and parents
> 2. Achievement test scores
> 3. Grades
> 4. Recommendations of principal, home room and shop or home economics teacher
> 5. Safety habits (boys, especially)
> 6. Attendance (girls, especially)
>
> Choice of vocational courses in other high schools is based upon one or more of the following:
>
> 1. Interest of student
> 2. Interest of parents
> 3. Counselor or teacher suggestion.[9]

Some cities indicated the screening of students through the use of standardized or locally developed tests and the application of either a pre-determined cut-off score, or a sliding cut-off score determined on the basis of the number of applications received.

[8] Letter, San Antonio Independent School District, San Antonio, Texas, Robert P. Klauer, Vocational Counselor, August 16, 1968.

[9] Letter, Portland Public Schools, Portland, Oregon, Hannah H. Larsen, Acting Supervisor, Guidance and Counseling, July 17, 1968.

Of the thirty-six major cities responding, sixteen outlined specific citywide programs of testing and interviewing for the purpose of selecting students for trade programs. It was evident, however, that selection procedures varied within these cities.

Responses from sixteen cities indicated free entrance policies which permitted all interested students to enter vocational training and, that as a policy, there was no use of a predictive or selective test for their programs. The following statements illustrate this policy of selection.

> The policies employed by this school district in the placement of pupils in vocational and occupational programs are relatively simple: anyone who desired to participate may do so, the only qualification for placement in the so-called work-experience programs being that a student is a senior and is reliable.[10]

> For too many years vocational educators, like too many educators, have been interested in screening students out of their programs. This procedure eliminated many students who could benefit most from this type of education. Three years ago we decided to take a different approach in Pittsburgh and admit all students who applied for our programs. Once a student has been enrolled in these programs it is possible that he can "spin-off" at a level whereby he can graduate with a saleable skill....We think it better for a student to graduate with a partial skill if that skill will make him employable.[11]

Several cities reported programs of prevocational exploration and orientation. Two indicated that students were exposed to the trade programs that were available in vocational schools:

> We have been able to give each pupil who applied an opportunity to try the work in our vocational schools to determine whether or not he is fitted for that particular trade.[12]

[10] Letter, Sacramento City Unified School District, Sacramento, California Duane K. Ash, Guidance Coordinator, July 16, 1968.

[11] Letter, Pittsburgh Public Schools, Pittsburgh, Pennsylvania, Louis J. Kishkonas, Assistant Superintendent, Occupational, Vocational and Technical Education, March 21, 1968.

[12] Letter, Boston Public Schools, Boston, Massachusetts, Thomas A. Roche Director, April 2, 1968.

> This year, for the first time, tenth grade students were selected for vocational survey courses. Each student was exposed to several different vocational areas to help him select his vocational field in grades eleven and twelve.[13]

Summary of Selection Procedures in Education

Of the several cities and states responding only a limited number indicated statewide or citywide procedures used in the selection of students for trade training programs. The selection of students for these programs seemed to be on the basis of local educational policy and decision making. Where vocational courses are offered in non-vocational schools, different standards seem to be applied for entrance into the same courses offered in vocational schools.

Responses indicated that little or no prediction of student success is being attempted on the 8th, 9th or 10th grade level. Where standardized tests are administered specifically to students wishing to enter trade training programs the scores obtained by student on these tests appear to be used as a basis for screening rather than prediction.

A large majority of responding educational agencies indicated that many factors including testing and the total record of the student was taken into consideration in the guidance or placement of students in trade training programs. Several cities reported that they employed an open-door policy in admitting students to trade programs.

Policies and Practices in Industry

One hundred and fifty major industrial corporations throughout the country were asked by letter (p. A-10) and follow up letter (p. A-11) to provide information relative to selection methods or prediction of success being used in the selection, placement, and promotion of employees in various occupational

[13] Letter, Trenton Public Schools, Trenton, New Jersey, Richard T. Beck, Superintendent of Schools, June 28, 1968.

positions.

Of the 40 corporations responding, four reported no use of tests except as they relate to specific skills required for the job. An explanation of such "simple" programs were presented by such statements as:

> ...we do not use"tests", beyond such 'ordinary tests as typing and shorthand for clerical jobs and very few tests for shop trainees... (United Aircraft)

> ...our company does not rely heavily on tests in the screening and selection of applicants. We do use specific skill tests where applicable, such as typing, shorthand, clerical skills, arithmetic skills, etc. These tests are not universally applied, of course, but are used in all of those cases where a short, simple testing procedure is available in relation to the specific job to be filled. (Wilson)

Five corporations reported programs of campus recruitment, plant visitation, reevaluation of their testing and employment screening procedures, classified advertising, and construction of their own tests. These varied as follows:

> Briefly, our program consists of campus recruitment, plan visitation and job placement. Our recruiting is done to prescreen potential applicents with respect to their qualifications and work interests. Those having the combination of interest and qualifications for our job openings are invited to visit out plants to further see if job interest and qualifications are aligned. This trip also gives the potential employee an opportunity to analyze the community in which he might live. (Dow Chemical Co.)

and:

> ...we are currently reevaluating our testing and employment screening procedures and are undertaking a program of test development and validation (with particular reference to issues of Equal Employment) which quite likely will result in significant revisions of past practices.
>
> Screening devices have been used by our company for several decades and will be continued during the interim period until new procedures are developed. However, instruments which will still be used will be given relatively little weight in the total employment process and in almost no case will a test score represent a major or determining factor in a job offer or rejection decision. Tests which will be used in a supplementary fashion during this period will be limited to three general types, i.e. general mental ability, clerical accuracy, and measures of skill or proficiency (shorthand and typing). When test scores are used in conjunction with other phases of the employment process (including interviews by line supervisors) the emphasis will be in terms of evaluating minimum qualifications rather than the more

> traditional "improving the batting average". Low test scores seldom, for example, will be considered an adequate basis for rejecting applicants from minority or disadvantaged groups. Somewhat greater weight will be given to scores of applicants from backgrounds judged more similar to the applicant and employee populations on which tests were validated against performance criteria in the past. (The Standard Oil Company)

and:

> Because of the disrepute into which testing has fallen and because we had some mental reservations about its value anyway, we have completely thrown out all testing with the exception of a couple of experimental test matters in which we as yet have no results. (Swift & Company)

Twenty-three corporations reported programs of intensive testing programs. Five of them, however, qualified the uniformity of the procedures used by indicating variances due to the autonomy of divisions within the organizations. Series of test batteries were reportedly administered in varying degree for mechanical aptitudes (mechanical reasoning, insight, and comprehension). Test batteries included numerical, verbal, personality and performance tests. Typing, shorthand, and keypunch tests and tests to measure reading ability, space relations, and numerical ability, as well as interviews and reference checking were also used.

Potential employees in another of the reporting corporations are selected as a result of the use of various selection steps including a

> ...specially designed test battery, depending upon the level of the position, which includes measures of intelligence, interests, sales know-how, supervisory know-how and personality traits; it is stated that we do not eliminate applicants for employment because their test scores fall slightly below the published norms. We use the tests only as a guide and, in some instances, to help us in supervising and training the person after placement. (Ga.-Pacific Corp.)

Eight corporations reported inability to contribute information because their selection procedures vary or are being revised.

MAJOR STUDIES OF SELECTION AND PREDICTION

The Connecticut Predictive Testing Study

In order to define more effective instruments for use in the selection of students for trade training programs on the secondary level a study was conducted in 14 state operated vocational-teachnical schools in the State of Connecticut. In this study five standardized forms were administered to entering students. Three of these forms were standardized tests: the Primary Mental Abilities, the Stanford Achievement and the Flanagan Aptitude Classification Tests. Two of the forms were of the interest inventory variety: The Gordon Occupational Checklist and the Survey of Interpersonal Values.

The standardized test forms consisted of 30 sub-tests or variables which were used as a basis for prediction in terms of their correlation with specially prepared criterion measures. These criterion measures were in the form of test scores achieved on skill and information tests developed for the study and administered at the end of secondary school trade training programs in trade machine shop and trade electrical shop. As a result of the first year concurrent pilot study using these test forms it was possible, on the basis of correlations, to eliminate 15 of the variables and reduce the testing time required for the entire battery from 21 hours to less than 14 hours.

It was determined that because the initial selection of students had been based largely on interests expressed prior to entrance into trade courses that the use of the Gordon Occupational Checklist, and the Survey

of Interpersonal Values after entrance into these programs did not serve the purpose of this study. To be of value in prediction the administration of interest inventories prior to entrance into a trade training program would seem to be more reasonable than the administration of these forms after entrance into trade training programs.

In the second phase of the study 15 variables from the three standardized test forms were used. They included four of the original 19 sub-tests of the Flanagan Aptitude Classification Test, five sub-tests of the Primary Mental Abilities Test and the six sub-tests of the Stanford Achievement Test. Once again the scores achieved by subjects on these tests were used in correlation with the three criterian measures (theory, practice, total score achieved on theory and practice tests).

The Pearson Product Moment Coefficients of Correlations obtained for the 15 predictor measures and the three criterion variables for the electricity group seem to indicate that predictors are generally more effective for electrical trade training. The Primary Mental Abilities Sub-tests and the Stanford "usage", "computations", "concepts", and "applications" tests seemed to be the most effective predictors for this group. The Flanagan Sub-test on "Judgment" correlated with success in "theory" at the .01 level.

In the use of predictors for the selection of students for machine trade training it was found that only one of the Primary Mental Abilities Tests had correlations at the 5% level and four of the Stanford Achievements tests had correlation at the 5% level or better. In this group the sub-test

on paragraph meaning had a correlation with the theory criterion at the .005 level. In the machine shop group there was correlation of the Flanagan sub-test on reasoning with success in "practice" or performance at the .025 level. There was correlation with success in both theory and practice at the .05 level in the Flanagan "Judgment" Test. There was high correlation of the sub-test "Scales," (.005), in relation to theory and somewhat lower, (.05), in relation to practice.

In summary it was noted that the PMA and the Stanford sub-tests seemed to be most useful in the prediction of success in electricity. On the other hand the sub-tests of "Reasoning," "Judgment," and "Scales" from the Flanagan sub-test seem to be the most useful for the prediction of success in machine shop training.[1]

The Harvard Study on Vocational Decisions

In a study involving the student directly in occupational decision making, the Harvard Graduate School of Education in cooperation with the New England Education Data Systems and the Newton Public School System is developing a computer-based Information System for Vocational Decisions (ISVD). The program is to be designed so that students have direct access to data about themselves and to data about occupations, colleges, trade schools, military

[1] New York University Center for Field Research and School Services. "Predictive Testing for Entrance in Vocational Technical Schools." August 1968.

services, and personal and family living.

The computer is programmed to provide the student with relationship between these areas which will equip the student with a body of information to assist him in making decisions pertinent to his occupational or educational goals. To identify student characteristics, data is gathered which includes: (1) Yearly marks in major subjects, (2) term marks for 9th grade, (3) 3rd, 6th, and 8th grade IQ scores, (4) 6th and 8th grade STEP scores, (5) a summary of 6th grade teachers' ratings, (6) vocational plans expressed in 7th grade, (7) work experiences, interests and vocational plans, (8) a record of all city-wide standardized test scores, (9) high school educational and vocational record, and (10) high school mark reports. Other tests of particular relevance to ISVD purposes such as, Kuder Vocational Preference Record, the Differential Aptitude Test, the Kelly Role Repertory Test, O'Hara's Vocational Self-Concept Index, the McSherry and O'Hara Test of Occupational Knowledge, and Gribbons' Readiness for Vocational Planning are being studied for possible inclusion in the computer program.

Gribbons' RVP originally developed as a structured interview has been adapted to a paper and pencil, group administered instrument. O'Hara's Vocational Self-Concept Index was altered and called the Self-rating of Abilities, Interests, and Values. It consists of all ten Kuder scales, the Allport-Vernon-Lindsey Study of Values scales, five of the DAT scales, and includes the general concept of "Intelligence."

Through a question and answer, or game-playing, session with the computer

the student will be able to compare such things as his characteristics. aptitudes, abilities and interests to a student who has been successful in the selected area. The comparison will assist the student in making a realistic appraisal and choice of his occupational and educational goals.[2]

The Los Angeles Trade School Study

Crawford studied the use of available tests in the selection of vocational education students. She reports that IQ tests and scholastic achievement tests used in combination with high school grade point average, so often used to predict college achievement, are not the best predictors for success in vocational classes and therefore have limited value in selecting vocational students. Research conducted at the Los Angeles Trade-Technical College has led Crawford to conclude that "...measurement of individual traits and separate factors of intelligence followed by empirical combination of these measures into aptitude test batteries specifically designed and weighted to predict success in specific areas of training within a specific institution is a far better approach to the problem."[3] She recommends the "...trait and factor theory as the basis of the selection of students for vocational training."[4]

2 Harvard Graduate School of Education. "Information System for Vocational Decisions." Annual Reports 1966-67, 1967-68.

3 Crawford, op. cit. p. 2

4 Ibid.

Continued research over a fourteen year period, testing over 8,000 applicants annually has been responsible for the development and validation of aptitude test batteries for some fifty-five trade and technical curricula. The development of these batteries was based on the premise that "...man possesses many different kinds of intelligences and that these intelligences are identifiable and measurable by standardized tests of relatively 'pure' abilities."[5] The investigator determined the intelligence factors necessary for success in specific occupations by utilizing job analysis. With the specific factors identified, aptitude tests, measuring each factor, were combined into test batteries to assess the student's potential for specific occupations.

The test batteries selected were then the subject of experimental research. The aptitude tests chosen for the final battery are those showing the greatest relationship, correlation, with the criterion measure, teacher ratings, and the least correlation with each other.

Two of the group of occupational areas studied, electronic technician and machine shop, have direct relevance to this study and deserve careful analysis.

An experimental battery of: (1) SCAT Quantitative, Progressive Matrices (Non-speeded and non-verbal reasoning), (2) Guilford-Zimmerman Aptitude Survey Part 6 Spatial Visualization, (3) SRA Shop Arithmetic, and (4) PMA Reasoning, and PMA Word Fluency was administered to students newly enrolled in the

5 Ibid. p. 6

electronic technician course. Upon completion of their training the students performance was rated by their instructor. This rating was correlated with the aptitude test scores. The aptitude test selected for the final battery on the basis of highest correlation with the ratings and least correlation with each other were the: (1) Science Research Associates, Mechanical Aptitudes Shop Arithmetic, (2) Guilford-Zimmerman Aptitude Survey, Part 6 Spatial Visualization, (3) Progressive Matrices (Non-speeded and non-verbal reasoning) and (4) Primary Mental Abilities Word Fluency. The battery had "...the correlation Multiple R. 68 between the total battery scores and performance ratings of class achievement as determined by grades at course completion."[6]

Entering machine shop students were tested with an experimental battery consisting of the: (1) Guilford-Zimmerman Aptitude Survey Part 4 Perceptual Speed, and Part 7 Mechanical Knowledge, (2) Dexterity Preferred Hand and Assembly of Small Objects, (3) Army General Classification Test, Vocabulary, Arithmetic, and (4) Guilford-Zimmerman Temperament Survey, "A" Ascendence, "O" Objectivity, and "E" Emotional Stability. The aptitude tests selected for the final battery were (1) Guilford-Zimmerman Part 4 Perceptual Speed and Part 7 Mechanical Knowledge (2) The Army General Classification Test of Arithmetic, (3) Guilford-Zimmerman Temperament Survey "E" Emotional Stability and, (4) Dexterity Preferred Hand. The battery had a correlation Multiple R. 75 between the total battery scores and performance ratings of class achievement as determined by grades at course completion.

6
Ibid. p. 8

The selection process used by Crawford involves the test batteries and an "applicant-instructor-counselor interview." The interview considers factors such as health, age, work experience and training. Crawford states that:

> In general those applicants are accepted for training who make a total battery score equivalent to a total battery score at the 33rd percentile or above based on norms developed on the experimental group. Those applicants scoring below this cutting point are referred for further counseling. Such applicants are encouraged to investigate other offerings of the college more consistent with their abilities.[7]

As a result of the testing and guidance program developed at the Los Angeles Trade-Technical College "Teachers feel that they are getting 'better' students; they know more about the potential of their students (the files are open to them while working with a counselor); there are fewer class interruptions; dropouts have decreased materially and criticism of discrimination is practically non-existent."[8]

Research on General Vocational Capabilities

Altman conducted a study to describe a domain of general vocational capabilities. He sampled 31 occupations which were identified as having major employment opportunities over the coming decade.

7 Margaret L. Crawford. " Available Tests and Their Use in Research in Vocational Education." Los Angeles Trade-Technical College, March, 1966.

8 Ibid.

Two of the occupational areas chosen for study, mechanical and electrical, have particular relevance for this study. The mechanical area was identified as having "...special relevance to occupations such as repairman, machinist and mechanical engineer..."[9] The electrical area was identified as having "special relevance for occupations such as electrician, appliance serviceman, assembler, instrument repairman, electronic technician and, electrical engineer..."[10]

The investigators described the jobs within each occupational group and their component tasks and a random sample of occupational task behaviors was drawn for each occupation. Selected behaviors were then translated into multiple-choice test items. The results of testing 10,000 students from grade nine to Junior College did not identify a clear factor structure but did suggest that the vocational content of the tests might be structured along a "hardware-to-people" continuum. By assigning each test item to a rationally defined test on a judgmental basis, on the basis of the hardware-to-people continuum, twenty-four capabilities tests were developed, scored, and correlated. The nature of development and change of general vocational capabilities were measured by comparing twelfth graders with a composite of students from other grades. The SRA verbal and numerical scores, amount of training, average grade, and students liking for a number of course areas

9 James W. Altman. "Research on General Vocational Capabilities (Skills and Knowledges)." Pittsburgh: American Institutes for Research, March 1966, p. 49

10 Ibid. p. 53

were gathered. These data were correlated with the vocational capabilities test scores for twelfth graders. In the mechanical area the investigators report that students performance was highly correlated among the mechanical area tests of: tools, mechanical systems, measuring instruments, stationery equipment operation, vehicular operation, connections and fittings, and fluid systems. Correlations are also relatively high with the electrical, spatial, and materials-chemicals part of the chemical-biological area. Correlations between mechanical tests and service, etiquette, and style tended to be quite low or slightly negative. It was noted that male students taking more than one semester of drafting, electricity, metals, physics, and woodworking scored substantially higher than those students not taking these courses. Female physics students were reported as scoring higher mean mechanical scores than the means for all male students. Students who took more mathematics scored somewhat higher on mechanical tests than did students taking less mathematics, except in stationary equipment. Students who reported higher course grades in drafting and electricity had slightly higher mechanical test scores. There was some indication that students who liked chemistry and those who disliked English scored higher on mechanical tests.

The electrical area was reported as being highly correlated with mechanical tests and related to other tests and course data to approximately the same degree as the mechanical tests, however, there was greater relationship to general science and physics.

Altman suggests that the premature exposure to vocational processes

whose demands are difficult or beyond the students stage of development may be responsible for unnecessary irrationality in the development of vocational interests and motivations. He also notes that the exploration of one's occupationally relevant capabilities and limitations viewed from an understanding of occupational vocational behaviors will provide a valuable perspective for career choice and planning. This approach to the domain of general vocational capabilities is viewed by the investigator as consistent with the guidance objective of rational career choice and effective career planning and may contribute to the discovery of information that will assist in career development.

Predicting Development of Young Adults

Cooley and Lohnes conducted a research study into the long-range implications of personality measurement profiles of youth. The primary purpose of the study was to "...describe the relationship between adolescent personality and the educational and vocational development of young adults..."[11]

During the 1960 a sample of about five per cent of American 9th through 12th grade students, almost half a million students, were tested and inventoried. The first and fifth years after graduation from high school the subjects were contacted by questionnaire in an attempt to establish "...a

[11] William W. Cooley and Paul R. Lohnes. "Project Talent, Predicting Development of Young Adults." Pittsburgh: American Institutes for Research, 1968 p. 1-12.

number of important and useful predictive validities of their high school personality profiles for criteria of adult development."[12]

The predictors used in this study were selected from 60 maximum performance scales of the Talent battery and from 38 typical performance scales. There were 11 abilities factors selected: (1) verbal knowledges, a g factor, (2) Mathematics, (3) English Language, (4) Visual Reasoning, (5) Perceptual Speed and Accuracy, (6) Memory, (7) Hunting-Fishing, (8) Screening, (9) Color, Foods (10) Etiquette, and (11) Games. The investigators report that for most of the studies under Project Talent two Verbal Knowledges and Mathematics were the powerful predictors. There were 11 motives factors selected: (1) Conformity Needs, (2) Impulsion, (3) Scholasticism, (4) Activity Level, (5) Business, (6) Outdoor and Shop, (7) Cultural, (8) Science, (9) Leadership, (10) Sociability and, (11) Introspection. The investigators report that "Scholasticism (or academic orientation) and the four interest factors (Business, Outdoor and Shop, Cultural, Science) turn out to be the most generally potent predictors from this domain."[13]

The adolescent personality of a student in any given grade was represented by his set of scores on the combination of the 11 abilities factors and the 11 motives factors.

In a study of ninth-grade boys who became dropouts it was reported that English Language ability (abilities domain) was their leading ability

12 Ibid. p. 1-12

13 Ibid. p. 1-12

deficiency while high impulsion scores (motives domain) characterize the dropout group.

The investigators view of vocational guidance is "...to help young people to develop broad and comprehensive cognitive maps placing themselves in relation to the 'continents' of the world of work before attention is allowed to narrow down to details about specific occupations as objects of choice."[14] The student, in order to cope with and adjust to a rapidly changing technology, should be aware of his abilities and capabilities and be familiar with areas where these may be applied rather than orienting himself to a specific occupation. In these terms predictions should identify a number of possible occupational choice. It was the investigators objective "...to present youths with information they can apply in their decision making, not with authoritative prescriptions they are required to take on faith."[15]

On the basis of ninth-grade students expressed occupational aspirations the investigators classified them as either people or thing orientated. The students were sampled again when they were one year out of high school. The expressed occupational choice at this stage indicated that of the students who were technically or thing oriented in the ninth grade 48 per cent retained this occupational aspiration over four years of adolescent growth and development, while 70 per cent of the people oriented retained their occupational aspiration.

14 Ibid. p. 3-14

15 Ibid. p. 4-43

This approach to occupational choice is designed for use with students around the fifth or sixth grade level when the people-thing orientation first appears in student talk about vocations. A second level career criterion covering grades seven through ten was established by dichotomizing the people-thing categories into College and Noncollege. The investigators believe that career choice can be expedited at this level if students organize their knowledge of school and work under these established four categories. They report that the four-category criterion has demonstrated considerable stability over the period from ninth grade to one year out. The information available to a student "...on how these categories are predictable from ninth-grade personality profiles can help him to decide how to categorize himself in the light of his personality profile, without coercing him in any way."[16]

A third-level career criterion covering grades eleven to fifteen was established by again dichotomizing each of four-category criterion. This expanded career choice included an eight-category variable which further refines career choice into: (1) College, Biological-Medical Science, (2) College, Physical Science or Engineering, (3) Noncollege Technological, with Training, (4) Noncollege Technological, No Training, (5) Noncollege Nontechnical, No Training, (6) Noncollege Nontechnical, with Training, (7) College, Business, and (8) College, Sociocultural. The results of a distribution of students one year out of high school among these eight categories shows that the

16 Ibid.p. 4-48

later career choice is contingent on their ninth-grade choice on the People-Thing variable and also contingent on their choice on the four-category variable.

Over this one year period in late adolescence it is reported that stable career transitions predominate. However, there are some areas where "path-jumping" or career changes occur. Twenty-six per cent of the College Science group changed to College Sociocultural and twenty eight per cent changed from Noncollege Nontechnical with No Training.

A fourth and final career criterion level of twelve-categories, beginning at grade 16, was established by dividing each of the four college cells of the eight-category variable by two according to whether or not advanced graduate study is planned.

Student choices on the career criterion levels "...reveal that plans stabilize considerably after high school graduation." "...The interpretation might be that the first year out of high school is a time of significant reality-testing and development of commitment."[17]

The established career criterion levels form what the investigators label as a "Career Development Tree." A forward path through this tree structure represents a stable career patter while "path-jumping" represents an unstable pattern. The tree structure spans the time from grades 4 to 16 and the investigators state, "...locations at given times ahead and transi-

[17] Ibid. p. 4-56

tions are predictable from personality attributes measured in adolescence."[18]

In determining the predictability of the career criterion variable from the high school personality factor profiles the investigators used: (1) a multiple group discriminant analysis for concurrent validity, (2) predictive validity based on the five-year follow-up, and (3) a discriminant analysis of change groups.

For the concurrent validity study Scholasticism (motives domain), Mathematics (abilities domain), Science Interests (motives domain) and, Verbal Knowledges (abilities domain) were the four best predictors. Thus, it is reported the abilities and motives domains of personality both contribute to the predictability of students plans.

The second multiple group discriminant analysis of the five-year follow-up indicates that the three best discriminants are practically the same as those in the concurrent criterion study.

The third analysis provided "Further evidence of the stability of the heuristic model for a psychometric taxonomy of career plans..."[19] The six most useful predictors are the same factors that were identified in the other two analyses.

The investigators conclude that predictions based on their model "...will be fairly sharp but not so precise as to represent a prescription."[20]

18 Ibid.

19 Ibid.

20 Ibid.

They recommend a computer measurement system that will provide the student seeking guidance with a prediction of the distribution of possible career choices for a person with his present plan and attributes (as measures by Abilities and Motives factors), and not a prediction directing him to one specific career category.

The University of Minnesota Project Mini-Score*

If we accept the fact that better counseling tools are needed to do a better job of student advisement, we must ask: What kind of tools can be developed which are valid and reliable? One of the most efficient ways of developing such tools is through the development of a testing program which will provide information concerning the likelihood of student success in an occupation, a method of development similar to that used in developing testing programs used in advising college students. Attempts at developing and validating such testing programs for the non-college bound have not met with much success in the past. It is reasonable to assume that most of these studies have failed because they have dealth with a very limited number of personal ability or needs measures and were based on a small number of individuals. Also few of the studies have included data on a large number of occupations. Individuals are complex and are not readily distinguishable

*Material presented relative to Project Mini-Score was prepared by Dr. David J. Pucil, Assistant Professor, Department of Industrial Education, University of Minnesota

on the basis of any one trait. They do tend to differ, however, on the basis of patterns of traits. The same is true for persons in given occupations.

If one reads current reviews of the literature concerned with counseling vocational students, (Ghiselli, 1966, Prediger, 1968)[21] it becomes apparent that little integrated research has been done to assess the interrelationships among various measures of abilities and needs and how these measures may be used effectively in the counseling process when dealing with many different training programs assumed to prepare students for different occupational families.

The Development of Vocational Counseling Tools

It is imperative that vocational counseling tools be adopted only after extensive research. This research must demonstrate which measures can be used effectively to provide the kinds of information needed. An example of this type of developmental program is Project MINI-SCORE. Currently, Project MINI-SCORE is being conducted by David J. Pucel and Howard F. Nelson from the Department of Industrial Education, University of Minnesota, to investigate the feasibility of developing such counseling aids to be used in advising students who wish to enter the post high school Area Vocational Technical Schools of Minnesota. A test battery consisting of six instruments designed

21 E. E. Ghiselli. "The Validity of Occupational Aptitude Tests." New York: John Wiley and Sons, 1966; Prediger, loc. cit.

to measure different facets of an individual's personal traits as they relate to occupational success is being used by the Project. The instruments are:

1. a personal information sheet which gathers educational history and occupational preference information.
2. the General Aptitude Test Battery (GATB) which measures aptitudes.
3. the Minnesota Vocational Interest Inventory (MVII) which measures vocational interests.
4. the Sixteen Personality Factors Questionnaire (16-PF) which measures personality dimensions.
5. the Minnesota Importance Questionnaire (MIQ) which measures the needs and individual would like to have satisfied by a job.
6. the Vocational Development Inventory (VDI) which measures the maturity with which a vocational choice is being made.

Data from a seventh instrument, the Minnesota Scholastic Aptitude Test (MSAT) is also being gathered from the files of the Minnesota Statewide Testing Program which stores MSAT scores for most Minnesota high school juniors.

All students who applied to the cooperating Area Vocational Technical Schools of Minnesota between September 1, 1966, and October 1, 1968, took the Project MINI-SCORE test battery providing a population of about 17,500 applicants. These students applied to occupational programs which were combined into 60 relatively homogeneous groups.

Some of the applicants were accepted and received training or are now receiving training. An investigation of the ability of each of the instruments to predict both training success and success on the job one year after successfully completing training is now underway.

Preliminary Investigations Which Indicate the Development of Effective Occupational Counseling Tools May be Feasible

To date, the preliminary results of Project MINI-SCORE have been encouraging. An investigation of the intercorrelations between the tests included in the battery have shown that each is measuring relatively independent factors (Pucel and Nelson, 1968).[22] The study had two major objectives, (a) to determine if each of the data gathering instruments was measuring relatively independent factors, and (b) to determine if the factors measured by the data gathering instruments had potential for differentiating groups of students applying to different vocational-technical curricula.

The population consisted of 1391 students selected by traditional methods and newly enrolled in one of the eighteen different vocational-technical curricula at one of the Minnesota Area Vocational Technical School during the fall of 1966.

The following eighteen curricula were selected to be used because each had at least 25 newly enrolled students. As one can see, not all of the curricula selected are trade and industrial education curricula, but they represent a cross-section of the curricula offered in those schools. The curricula were:

Accounting
Agri-Technology
Architectural Drafting
Automotive
Fluid Power Technology
Machine Shop
Mechanical Drafting and Design
Power and Home Electricity

22 Pucel and Nelson, loc. cit.

Carpentry	Practical Nursing
Clerical Training	Printing and Graphic Arts
Cosmetology	Sales
Data Processing	Secretarial Training
Electronics	Welding

The seven data gathering instruments provided 105 different measures on each of the subjects tested. The mean and the standard deviation of each of the 105 variables and an intercorrelation matrix between the 105 variables was calculated separately for each of the eighteen curricula.

Two sample t-tests were run to determine which variables were capable of significantly differentiating between at least the two of the eighteen curricula which represented the extreme mean scores on each variable. After calculating the t-test for each of the 105 variables, it was determined that all of the variables except one distinguished between the two most extreme curricula at the .05 level of significance or higher. Age was the only variable that did not distinguish between the extremes at or above the .05 level of significance. Such a finding is to be expected since almost all of the enrollees were recent high school graduates.

The correlation matrices were examined to determine whether or not each of the data gathering instruments was providing data relatively independent of data obtained from any of the other instruments. The criterion used to judge whether or not two factors measured by two different instruments were relatively independent was a correlation of .55. A correlation of .55 between two sets of scores indicates that each is measuring 30.25% of what the other is measuring; or conversely, 69.75% of what each is measuring is

independent of the other. For purposes of the preliminary analysis, approximately 70% non-overlap or independence was judged to be sufficient to indicate that two measures were relatively independent.

A review of a sample of four of the eighteen correlation matrices indicated that none of the factors measured by one instrument correlated above .55 with factors of another instrument except the Minnesota Scholastic Aptitude Test Score and the GATB Verbal Aptitude Score.

A second investigation has shown that the occupational groups used by the Project are capable of being empirically clustered based upon profile similarity using each test separately (Pucel and Nelson, 1968).[23] The second investigation used the same population as the first. The commonalities between groups enrolled in the eighteen vocational programs were investigated with respect to interests, aptitudes, job needs and personality factors.

Profiles for each of the eighteen curricula were constructed using standard scores for each of the multifactor instruments used in the project (MVII, 16-PF, MIQ, and GATB). A combined profile was also constructed for each curriculum using all of the scales on all of the instruments indicated above. The commonalities between the profiles were determined by using DuMas coefficient of profile similarity. By inspection, profiles were then grouped on the basis of profile similarity coefficients.

Based upon the curriculum groupings derived from the empirical profile

23 Ibid.

comparisons for each test separately as well as for the combination of the tests, some curricula consistently grouped together. The groups derived from the comparison of the combined profiles appear to represent a summary of all of the profile groups derived from the individual tests.

Based upon the combined profiles using the seven aptitude scales obtainable from the written portions of the GATB, the nine MVII homogeneous scales, the 16-PF sixteen personality factors scales and the MIQ thirty needs scales, the following clusters were found. The total number of dimensions in each profile was 62.

a. GROUP 1

Electronics
Data Processing

b. GROUP 2

Power and Home Electricity
Carpentry
Automotive
Machine Shop
Welding
Fluid Power Technology
Architectural Drafting
Mechanical Drafting and Design
Agri-Technology
Printing and Graphic Arts

c. GROUP 3

Practical Nursing
Cosmetology
Accounting
Clerical Training
Secretarial Training
Sales

The curricula appear to consistently group in terms of trade and industrial curricula and business and social service curricula. Essentially the same curricula clustered together regardless of the test used, except for sales and agri-technology. This suggests that individuals in the groups are similar on many dimensions. They have similar needs, interests, abilities, and personalities as defined by the instruments used in this study. This does not mean that they are identical. Curricula within a group have profiles

more similar to curricula in the group than they do curricula outside the group.

It appears that certain jobs appeal to persons with similar characteristics as indicated by the fact that, with the data analyzed here, it has been possible to empirically cluster jobs based upon the characteristics of persons training for them. Such a finding with such a large number of variables could have direct significant implications for vocational counseling procedures.

The next step is to investigate the ability of these measures to predict training and job success. Even if predictive relationships can be established between test data and ultimate training success, this information must be summarized into one effective useful form.

An Ultimate Vocational Counseling Information System

After the Project MINI-SCORE staff have investigated the predictive validity of each of the instruments include in the test battery, each of those scales which have predictive validity will be used in developing an efficient counseling information system. Statistical tools have been developed which allow one to combine knowledge of many separate variables that relate to success in a given occupation into one score. Such a methodology is the centour methodology.

The centour method is based on the premise that it is equally undersirable to have too little or too much of a given aptitude or trait as compared

with successful people in an occupation. In general, one who is going to be most satisfied and successful in an occupation is one who is "like" the majority of others who are successful in that occupation. A centour score of 75 would indicate that an individual has a score or particular combination of scores which is closer to the average of a population of successful persons in that occupation, estimated from a criterion sample, than 75 per cent of the population. In other words, only 25 per cent of the people in the population of workers would achieve a score or combination of scores which was closer to the average score or score than he was. The number of variables used in the calculation of one centour score is limited only by logical interpretation. In other words, if 25 relatively independent measures were related to success in a given occupation, one could calculate one centour score which would condense the information on all 25 measures.

Using this methodology, a student who wants occupational training counseling could come to one of the Area Schools in Minnesota for testing. His test answer sheets would be sent to a central location for scoring. This central location would feed his scores into a computer and calculate his centour score on the basis of each of the 60 occupational groups described earlier. The centour scores would be calculated using information furnished by the Project from findings which would be stored in the computer. The counselor in that school would receive the individuals' test scores and centour scores. He could counsel the student using the centour scores for each of the 60 occupational groupings in terms of how alike his pattern of scores is compared with the scores of persons who had scores like his when

they came in for counseling and became successfully employed. If the student went to another area vocational school, that school could also obtain the scores by contacting the central source.

Development of Occupational Counseling Tools for High School Vocational Programs

Current findings of Project MINI-SCORE tend to support the premise that selected reliable and valid test data can be useful in counseling post high school applicants to vocational training programs. There would be little reason to expect that the findings could not be used with high school students during the senior year. However, a number of problems may arise if one tries to adopt the system directly to advising ninth and tenth graders in terms of high school vocational programs. Some of the problems are:

1. The reading level required of students who respond to a given instrument.

2. The level to which the aptitudes, interests, personality, etc. have developed as compared with persons out of high school.

3. The comparability of high school and post high school programs preparing persons to enter a given occupation.

The problems mentioned above would indicate that a new study should be conducted similar to Project MINI-SCORE for high school students. If one can expect or hypothesize that persons who enter high school vocational programs, successfully complete them, and become successful employees, and have characteristics which distinguish them from persons who are unsuccess-

ful, such a study is reasonable.

Assuming one does believe there are systematic differences, the findings of Project MINI-SCORE would be useful in selecting those variables which relate to success in a given occupation. The writer would expect that many of the variables identified as being related to success in post high school vocational programs would also be related to success in high school programs. However, the level of student development on the variables may be different, requiring different normative data. Appropriate measures of these variables would have to be found (correct reading level, etc.).

Some assumptions were made in the selection of instruments for Project MINI-SCORE which should be considered in selecting instruments for such a study. Standardized instruments were used because standardized instruments usually go through extensive investigation before they are published, which to some degree assures their reliability and validity to measure a given construct. It is difficult enough to establish a relationship between construct such as needs and job success when one has reasonably valid measures of each of them. If one complicates the issue by trying to develop instruments while investigating the relationship between constructs, he is never sure if inability to predict one construct from the other is due to the constructs not having a given relationship or the instruments not being valid or reliable. Therefore, if instruments are available, it is advisable to use standardized instruments which measure the construct as you define it

and not attempt to confound the investigation by developing instruments. If after a functional relationship has been established one wishes to construct his own instrument, he can do so and establish its validity by developing an instrument which correlates highly with a proven instrument.

Instruments were not used by Project MINI-SCORE which attempt to measure the amount of previous knowledge a person has of an occupational area at the time of application for training. The amount of previous knowledge a person possessed about an occupational area might be an indication of such factors as his interests, the availability of learning situations related to the occupational area in his environment, or his intelligence. One has difficulty determining which is operating for a given individual. In terms of vocational counseling, the critical question is not how much an individual knows about an occupational area when he enters training, but what is his potential for learning about the area so he can perform in it satisfactorily after training. This does not say competency tests should not be used as criterion measures of success in training, but it does question their use in counseling students in relation to entrance into training programs.

After the instruments have been selected, students would be tested at the time they received counseling in the ninth or tenth grades. Training program success data would have to be gathered as well as on the job success data through longitudinal data gathering. One would then examine the test data to determine which of the variables measured are related to success in

a given occupation. Norms and other counseling aids would then be developed.

Project MINI-SCORE has been in operation for about three years and preliminary results indicate that such a system can be developed for post high school students. Logic would suggest that if such a system can be developed for post high school vocational students one could be developed for high school students. Instruments and norms would have to be validated through a longitudinal study. Counseling tools would have to be developed based on the results and a master counseling information system established.

DISCUSSION AND IMPLICATIONS

One of the purposes of this study was to review and evaluate the usefulness of the standardized test in a battery or individually, the structured interview, interest inventories, industrial arts teachers ratings and checklists, and school marks as instruments of selection and predictors of success in vocational education. The evaluation of these instruments, as reported in the literature, seems to suggest that there is no conclusive evidence that any one instrument provides a solution to the problem of predicting success in trade training.

The prediction of anything as complex as human behavior seems hazardous at best. Prediction of success is further complicated, in this study, by the attempt to select students for training programs on the basis of behavior during the period of adolescence. The importance of this prediction cannot be over emphasized because it affects the opportunities of students to enter and engage in various occupational training programs and ultimately the occupational endeavors of the individual.

It is quite understandable that any agency which is responsible for the occupational advisement of people should seek reliable devices to aid in making wise occupational decisions. Ideally, such devices should have high predictive validity and should be easily and quickly administered. Needless to say, a great deal of effort has been invested in attempting to develop such instruments and devices. Up to this time. the evidence of the usefulness of these methods has been quite discouraging. It should be noted, however, that the methods and techniques reviewed appeared to have some application, in certain situations, in differentiating between the successful and unsuccessful vocational student. The lack of convincing, consistent evidence

on the general use of any one instrument or technique, particularly on the eighth and ninth grade levels, has left the question of how to predict vocational school success on this level open.

In general the results of research have varied widely from situation to situation, which may suggest that there are undefined variables which may be contaminating findings. Two factors, among others, may account for this. One is the extreme complexity of the psycho-socio patterns which determine job success and satisfaction. The other is the large and increasing number, and diversity, of occupations in modern technological society.

Crites (1968), defines vocational adjustment in terms of two components, (1) how well the individual performs the job, and (2) how much job satisfaction he enjoys on the job. After analyzing the capacity of all existing instruments to predict these elements, Crites states:

> The sad but true conclusion we must draw is that most of our assessment instruments have little or no predictive value in forecasting these two major criteria of vocational adjustment.[1]

The fact may well be that most individuals can succeed in any one of a great variety of occupations, and that the actual occupational choice may be determined by environmental influences almost entirely. We are frequently told that technology will require most workers in the future to change careers several times during their lifetime. There may be little or no relation between the different kinds of work engaged in. This raises further questions about the theory of matching people to jobs.

[1] John O. Crites, "Appraising the Appraisal Instruments." American Vocational Journal, December, 1968.

It appears that existing instruments seem to be limited in their ability to measure general job success factors such as cooperativeness, dependability, getting along with others and similar qualities, although these are the critical success factors in many, perhaps most jobs.

Prediction of vocational success might be improved by identifying variables that may be affecting the accuracy of measuring instruments and giving these variables appropriate consideration through score adjustment. This adjustment could be similar to the adjustment of GATB scores by Droege (1968)[2] on the basis of age. However, the evidence suggests that age is only one of many variables that should be considered when developing an instrument whose use could be adapted, by score adjustment, to differing geographical areas, schools, and possible adjustment to the individual student. Barnette and McCall (1963)[3] report that Negro students score lower than average on all ability measures with the exception of the DAT of Abstract Reasoning. They suggest that there are causal factors which at least in part determine the outcome of these ability measures. This illustrates the danger of assuming that an instrument is valid as a predictor of vocational success without consideration of variables that may affect the results. An instrument that does not take into account the variables that may be interfering with its accuracy may lead to predictions that are prejudical to some prospective students of trade training programs.

In the development of instruments for selection and prediction, the abundance of undefined variables appears to restrict the usefulness of such instruments to a specific situation where test norms are well established.

[2] Droege, loc. cit.

[3] Barnette and McCall, loc. cit.

If the instruments are to be general in nature and to be used in a variety of situations, consideration must be given to as many variables as can be accounted for. The adjustment of predictive instrument scores on the basis of such variables is already appearing in industrial employment where minority group applicants' test scores are weighed in consideration of the previously undefined variable of identification with a minority group. In another industrial application of predictive instruments minumal test scores were established which were flexible enough to consider such variables as (1) the condition of the labor market, (2) the requirements of the position at a specific time, and (3) other available information regarding the ability of the personnel in question.

This suggestion of identifying such variables and adjusting predictive instrument scores on their basis is not made without consideration for the dimensions of the task. The extended experimental research necessary will be both time consuming and expensive but, if successful, the end-product will more than justify these expenditures. In an age where technology has been responsible for the development of such sophisticated contributions to society as the computer and space exploration, the task of the educator in developing reliable and valid predictive instruments should appear in a more realistic perspective.

The use of an interview as an integral part of a testing program may provide the means necessary to proble for variables that may not be identified by test score alone but may play a vital role in determining the success of the prospective vocational student. Such an interview could be structured in an attempt to uncover any factors which might increase the probability of student success and might otherwise go unnoticed.

The role of a guidance system is to provide the student with a maximum amount of information about himself, in terms of such things as his aptitudes, interests, abilities, and about industry, in terms of such things as its needs and requirements. The student should be counseled to understand that his vocational capabilities equip him for a number of trade areas rather than limiting him to a specific occupational area. This awareness of one's self and the needs of a changing world of work has always been a desirable objective of student guidance. However, the increased rate of technological growth and change has placed a priority on realizing this objective. By attaining this goal the guidance system can establish a frame of reference which increases the probability that the student will make an intelligent occupational choice.

One method of disseminating test program information is with a computer system as recommended by Cooley and Lohnes (1968)[4] and under development at Harvard. The guidance counselor's role may, under these circumstances, have a tendency to change from one of close personal student relationship to one of student orientation to the computer system. Although there is little doubt that such a system will make a contribution to student guidance, there is some question about the possibly diminished role of the guidance counselor. It may be that the counselor adds an indefinable quality to student guidance through the interpersonal relationship he develops with the student. It might be hypothesized that the relationship developed assists in developing motivation and interest that may, at least in part, determine career choice. This role of the counselor may constitute one of the undefined variables previously mentioned.

[4]Cooley and Lohnes, loc. cit.

It would appear that an introductory course to expose prospective vocational students to a cross-section of industry and its requirements would assist the student in making a wise occupational choice and may also provide an on-the-job observation period which may help to identify those students who will be successful in vocational education.

A primary concern of those involved in student counselling is the guidance of the student towards an occupational choice with consideration of his vocational potential and industry's needs and requirements. Because of the present tnedency, as Cooley and Lohnes (1968)[5] suggests, of irreversibility in occupational planning, the main thrust of this guidance effort must be provided at the 8th or 9th grade level, before the student becomes "committed" to an occupational area.

Crawford (1966)[6] reported that applicants scoring below the 33rd percentile on a test battery were redirected for further counseling to identify other areas where their chances of success were greatest. The concept of establishing cutting-off scores or percentiles is questionable and objectionable to many vocational educators who feel that a cut-off measure is an arbitrary method of dealing with the problem of selection and may eliminate many prospective successful students. Vocational educators, on the basis of observation, report that boys who were identified as failures have often suddenly become "interested" and "motivated" in a particular vocational area and have become successful students. There may be, however, some value in setting a re-counseling score or percentile rather than using cut-off measures.

[5] Ibid

[6] Crawford, loc. cit.

The re-counseling score could be set after experiments with the predictive instrument being used gives some indication of the area where the probability of student success is questionable. The concept of re-counseling could be applied with two objectives in mind, (1) to determine if, regardless of low predictive scores, the student could be successful in the vocational area of his choice and (2) to discuss with the student opportunities in other vocational areas, if re-counseling indicates that he will fail in the area of his first choice. The obligation that the vocational educator has to each individual student to ensure that he has every chance to succeed and has the least chance to fail must be of primary concern in developing a system of student selection.

There is evidence that there is need for better occupational counseling to assist non-college bound students. The development of a reliable and valid system of selection and prediction will be invaluable addition to occupational guidance.

For the purpose of this study the development of instruments of selection and prediction will be delimited to the area of (1) a combination structured interview and interest inventory, and (2) an industrial arts teacher checklist and profile sheet. These instruments will be designed to measure variables such as cooperativeness, dependability and getting along with others that have been identified with success in trade areas. The paucity of related literature and research in these areas and the interest expressed by vocational teachers, administrators, and guidance counselors indicates a need for further research in these areas to which this study hopes to contribute.

PART III

THE DEVELOPMENT AND EXPERIMENTAL USE OF INSTRUMENTS FOR THIS STUDY

After meetings of teachers and administrators of vocational education, consultants, and the study team, instruments for use in the prediction of success in vocational subjects were developed for experimental use in selected vocational subject areas. The development of these predictive instruments was based on criteria developed by those participating in the study and the results of research. The research included the study of related literature and existing programs of predictive testing.

The Development of an Industrial Arts Rating Scale

The possible value of an industrial arts checklist for the purpose of evaluating student characteristics as demonstrated in industrial arts classes was suggested for investigation and experimentation. It seemed to be the opinion of vocational educators who attended the initial planning meetings that because of the close relationship of activities in industrial arts classes and those generally associated with successful performance in industrial occupations, the grades obtained by students in industrial arts classes might be meaningful indicators and possibly predictors of success in the machine or electrical trades. Industrial arts teachers were identified by those present as one of the most valid sources of information which might prove meaningful in the guidance and prediction of success of students in relation to various programs of vocational education.

Related Literature

As previously reported, a search of literature has revealed little meaningful research related to the checklist technique.

It was thought that an appraisal of industrial arts grades as predictors of vocational success might also provide information which might be meaningful in determining the prossible value of the checklist. Fleming (1939)[1] suggested that the industrial arts teachers' evaluation might include measures of habits of industry, initiative, dependability, accuracy, and other factors are not necessarily separately indicated in the evaluation or grade. Long (1957)[2] found that mathematics, social studies and reading comprehension were most effective predictors than industrial arts grades. Whitten (1961)[3] reported similar results and Moss (1966)[4] found that industrial arts grades did not differentiate between successful and unsuccessful vocational education students.

An examination of the related research does not seem to provide evidence that industrial arts teachers' grades are of value for the purpose of prediction. The work of Fleming does suggest however that the separate of the factors that contribute to the industrial arts grade may be meaningful in prediction. It is reasonable to assume that these factors when judged separately by the industrial arts teacher will provide a student profile which may have predictive validity.

1 Fleming, loc. cit.

2 Long, loc. cit.

3 Whitten, loc. cit.

4 Moss, loc. cit.

Additional research relative to the use of industrial arts ratings, and the use of checklists and profiles seems necessary to determine more conclusively the usefulness of the technique in prediction and selection.

The use of industrial arts checklists for guidance purposes has been suggested repeatedly in New York State Syllabi. It was suggested that the information provided by the checklist would be of value to the teacher and guidance counselor in helping the pupil with his school program, his selection of a vocation, and his placement in a job upon graduation or leaving school. Courses of study such as that for "General Woodwork" usually contained recommendations for the use of industrial record cards, on which would be included two lists of criteria relative to the type of information which the industrial arts teacher should observe and record. These lists usually were concerned with behavior characteristics primarily associated with adjustment to a shop situation, and items pertaining to general social behavior. Criteria for evaluating shop and social behavior were provided to indicate the type of criteria which might be developed.

An example of these criteria, taken from a State Syllabus follows:[5]

Ability to work with others.
Ability to solve practical problems or meet new situations.
Ability to plan.
Ability to work effectively with tools and machines.
Ability to follow through and complete a job.
Interest in small, large, fine or rough work.
Interest in quiet or noisy work.
A like or dislike of dirty or clean work.
A sense of timing in getting work accomplished.
Works willingly with fellow pupils.
Participates actively in group planning.
Accepts leadership responsibilities.

[5] Industrial Arts Syllabus in General Woodwork, Bureau of Industrial Arts Education, Division of Industrial Education, The State Education Department, University of the State of New York, Albany, New York, 1956. pp 77-78

Recognizes leadership of others.
Gives reasonable advice willingly.
Helps other pupils whenever possible.
Recognizes differences in individual abilities.
Shows consideration for the rights of others.
Goes at once to his work station.
Exhibits initiative in starting work.
Shows interest in improving workmanship.
Puts in a full work period.
Complete assignments.
Offers to participate in extra assignments.

The function of the industrial arts teacher in repeating and analyzing student characteristics has been expressed by Dudley.[6]

> Industrial arts teachers are in a unique position to report on and analyze the characteristics, abilities and performance of their students in respect to mechanical aptitudes, the relationships existing with fellow students and particular interest or skills in shop work. It appears that industrial arts teachers sometimes attempt to evaluate the student's characteristics to the extent that they become concerned about English usage, writing ability, social adjustment and other similar items. Actually, these are extraneous factors because the primary experiences that the students have in the industrial arts shop involve tools and materials and the working relationships in an industrial atmosphere.
>
> ...records serve a useful purpose in measuring the performance of the students, but often fail to lend themselves to a personal, professional interpretation on the part of the teacher.... In addition to the marking system, we also need a personal, yet professional evaluation of the student and his work which will be quite separate and apart from the marks or grades received.

In describing the role of industrial arts in guidance, one B.O.C.E.S. unit director, in a description of a project in the unit says, "...industrial arts functions as a natural guidance vehicle for occupational orientation, choice, and practical trial".[7]

[6] Arthur J. Dudley, "Characteristics, Abilities and Performance" Viewpoint, pp. 12-13, November, 1959.

[7] Ludwig Kadal, "Project M.I.T.E., Board of Cooperative Educational Services, Madison County, New York, 1969. (Rexographical).

Teachers and counselors have developed individually forms and checklists for the purpose of recording information pertaining to student characteristics for guidance purposes. The New York State Industrial Arts Association has developed, and stressed the use of such instruments, for the purpose of evaluation, during special sessions and at Annual Conferences during recent years. Dudley developed the "Student Behavior Summary for Industrial Arts" forms, which consists of twelve items in three groupings; ability to work with people, ability in mechanical performance, and ability to work with plans, ideas, and concepts.[8]

Detailed checklists for recording student characteristics in pre-vocational and trade subjects were developed by Kressel for the use of teachers in the New York City Vocational Schools.[9]

Smith developed and experimented with a student evaluation form for vocational-technical applicant evaluation, and found that it was a useful guidance tool.[10] A similar form was developed by Ash.[11]

Identifying Characteristics of Successful Students and Workers

Four approaches were used in the collection of information relative to success in machine and electrical trades which might be useful in the construction of a "characteristic"-checklist for use in industrial arts classes.

8 Dudley, Op. Cit.

9 Herman Kressel, An Experiment in Practical Aptitude Testing in Exploratory Trade Shops, High Points, Board of Education, City of New York, October, 1950, pp. 25-38

10 Ethel Smith, Board of Cooperative Educational Services, Chemung-Tioga County, New York, 1967. (Rexographed)

11 Duane K. Ash, "Teachers Evaluation Sheet", Board of Cooperative Educational Services, Tompkins, Seneca, Tioga County, N.Y. 1969 (Rexographed)

The first approach was that of determining those characteristics manifested by successful students in related vocational education programs.

The second was that of determining as far as possible those characteristics possessed by successful employees in machine and electrical trades, before high school entrance.

The third was that of determining those characteristics demonstrated by those presently employed in machine and electrical trade areas and rated as successful by their supervisors.

The fourth was that of determining, through a review of literature and occupational information handbooks, those characteristics associated with success in machine and electrical trades.

Characteristics of Successful Students

In order to develop a list of characteristics of successful students it was thought by the research team that meaningful information might be gained if vocational teachers were asked to identify and observe students who have been successful in their classes, and to list various characteristics of these successful students. Such a listing, it was believed, would provide information which would be used in the development of the content of the checklist.

Letters were sent to a representative group of teachers, supervisors, and directors of trade training programs asking them to list these characteristics (pg A-12). A work sheet (pg A-13) was provided with each letter for the convenience of respondents. The work sheet provided for open-ended responses and listings of characteristics under the headings of: personal, social, attitudes, interest patterns, temperament, and "other.

Characteristics of successful students in industrial arts classrooms, as observed and reported on by teachers, were tabulated in the order of the frequency with which they were listed.

Because of the open ended structure of the work sheet, various terms were used by the respondents to describe characteristics necessary for success. Synonymous terms were combined. Characteristics chosen by ten per cent or more of the 88 participating teachers and supervisors were considered to be meaningful for guidance purposes. Those listed by less than ten per cent did not seem to be meaningful. The characteristics identified under each category or heading, and the number and per cent of respondents selecting them are shown in Table 11.

Pre-employment Characteristics of Successful Workers

In the development of the checklist, as in the validation of the G.A.T.B., the assumption was made that an inexperienced untrained individual, in this case the student, having characteristics similar to a "successful" experienced worker would be likely to become equally successful in the same occupation.

The validity of the inference that those presently having characteristics similar to those who are successful will themselves be successful in an area of work is questionable because of possible bias, the subjectivity of observations, and because of other possible variables. It is also possible that certain characteristics evidenced by successful workers may have been developed on the job, or as a result of the job, rather than having a characteristic of the individual worker before he entered the occupation. Information relative to this factor can be gained objectively only through a longitudinal study.

TABLE II

CHARACTERISTICS OF THE SUCCESSFUL STUDENT

Characteristics	Eighty Eight Respondents: Number of Respondents	Per Cent of Respondents
Personal		
Clean and neat	53	60
Dependable	30	34
Honesty	17	19
Moderate Dress Habits	12	14
Good Health	12	14
Courteous	11	13
Cooperative	11	13
Social		
Ability to get along with others	40	45
Friendly	30	34
Courteous	22	25
Cooperative	18	20
Participates in school functions	10	11
Attitude		
Willing to work hard	20	23
Cooperative	19	21
Desire to learn	13	15
Respectful	13	15
Respect for the trade	9	10
Interests		
Define interest in vocational field	22	25
Interest in related fields	19	21
Mechanically inclined	12	14
Temperament		
Even tempered	44	50
Ability to accept criticism	19	21
Good self-control	12	14
Cooperative	12	14
Patient	12	14
Other		
Responsible	9	10

In order to determine the early characteristics of successful workers, however, an attempt was made in this study to determine, as far as possible, characteristics of successful workers at the late elementary school level as well as the characteristics they possess at the present time.

A questionnaire (pg A-16) using a projective technique was developed for the purpose of eliciting from workers, identified as successful, information about their interests, concerns, and personality while attending the eight grade.

Through this projective technique it was possible to view the worker as he was when he was in the eighth grade and then prepare, from this view a list of characteristics which might be expected of present eighth grade students for whom career projections are to be made. It was believed that the checklist method of predicting occupational success might be structured with consideration of this assessment of similarities between the characteristics of the successful worker of today as a student, and those of the student today.

Over 200 workers in the machine and electrical trades who had worked at their trades for more than five years and who had received two or more salary increases or promotions were asked, through the use of the projective questionnaire, to recall and list their interests and their activities during the eighth grade or during the period just before their entrance into high school. Part 1 of the questionnaire was devoted to "personal characteristics" which workers thought they possessed during their early school days and also those they believe they pos.ss at the present time. Part 11 was devoted to sections relative to work habits and interests. Information gained through the use of Part 11 of the questionnaire was also used in the development of the structured interview work sheet and Occupational Interest Checklist, described later in this study.

Present Characteristics of Successful Workers

A comparison of individual workers answers to questions dealing with personal characteristics at the late elementary school level and their personal characteristics at the present time, seemed to indicate that as a group they thought that, although some changes had occurred, little overall change had taken place. Change in personal characteristics reported by workers were in almost all cases, related to the acquisition of a desirable characteristic, or characteristics after the eighth grade. Only three "desirable" characteristics were reported as being less predominant after leaving the eighth grade, or at the present time. These were being: fashionable, hardworking, and obedient.

It was interesting to find that obedience, cheerfulness, neatness, punctuality, good attendance and the ability to accept criticism were characteristics reported as not being possessed by about one sixth of those responding although the absence of these characteristics were not all reported by the same respondents. There seemed to be little difference in the pattern of personal characteristics indicated by those in machine trades and those in electrical trades. No distinction therefore has been made for these two groups in relation to these data. Because there was little change reported by the majority of respondents it may be assumed that present characteristics of workers may be used as criteria in evaluating personal characteristics of those entering trade training. It may also be assumed for the purpose of this study that these characteristics are generally capable of being determined at the eighth grade level for the purpose of prediction. The subjectivity of answers based on re-call, however, are obvious. Early and present personal characteristics as reported by successful workers in machine and electrical trades are presented in Table 111.

TABLE III

EARLY AND PRESENT PERSONAL CHARACTERISTICS AS REPORTED BY SUCCESSFUL WORKERS IN MACHINE AND ELECTRICAL TRADES

227 Respondents

Personal Characteristics	Characteristics during Grade Eight		Characteristics at Present	
	WAS	WAS NOT	IS	IS NOT
Trustworthy	172	34	224	0
Dependable	185	25	226	0
Helpful	186	38	227	0
Friendly	182	40	226	0
Courteous	175	35	225	0
Respectful	163	20	226	0
Cooperative	175	20	224	0
Obedient	180	25	196	27
Responsible	160	65	219	0
Self-controlled	168	32	221	0
Patient	132	92	226	0
Accepts criticism	36	171	121	42
Even-tempered	133	93	210	15
Cheerful	184	36	178	35
Neat	152	60	182	33
Clean worker	156	65	226	0
Fashionable	60	122	45	127
Hardworking	170	30	165	36
Punctual	173	35	170	33
Good attendance	145	72	172	35

Part II of the questionnaire revealed interests of workers in the two trade areas both at the eighth grade level and at the present time. Once again, the present interests of workers appeared to remain similar to interests at an earlier age. There was a decreased drop, however, in interest in each item between the eighth grade and the present time. It was interesting to note that the interests reported by respondents remained in the same order of importance in most cases. Some changes in interests such as a decrease in interest in certain school subjects, sports, magazines and games may easily be attributed to maturity.

Interests indicated by workers as being those held during their early adolesence seem to parallel those listed as being typical of interests held by prospective workers in the machine and electrical grades in the Guidance Counselors Handbook. A tabulation of early and present interests reported by workers for this study appears in Table IV.

Part II of the questionnaire also presented the worker with an opportunity to check his preferences in reference to job characteristics. In each of the catagories, representing areas of preference in relation to job characteristics, mechanical interest predominated. Once more preference appeared in most cases, to remain similar although diminishing in number. Changes which did occur in some instances, may once again be explained on the basis of the acceptance of responsibility which is associated with maturity. Information pertaining to job preference items is presented in Table V.

TABLE IV

EARLY AND PRESENT INTERESTS AS REPORTED BY SUCCESSFUL WORKERS IN MACHINE AND ELECTRICAL TRADES

227 Respondents

Favorite Subjects	During Eighth Grade	Now
History	179	115
Science	152	85
Music	163	135
English	110	47
Health Education	126	23
Mathematics	56	15
Ind. Arts	52	14
Favorite Hobbies		
Making Things	210	172
Woodwork	133	69
Art Work	98	92
Metal Work	96	63
Favorite Games		
Pool	140	165
Checkers	156	33
Jig Saw Puzzle	92	10
Cards	65	93
Word Games	70	82
Favorite Magazines		
Airplane	215	7
Sports	182	35
Mechanics	156	132
Machinery	153	179
Westerns	149	129
Science	130	75
Scouting	122	39
Automobile	76	103

Favorite Sports	PLAY	WATCH	PLAY	WATCH
Baseball	178	35	62	97
Track	152	40	5	32
Football	110	99	68	125
Pool	72	65	33	20
Basketball	62	53	10	35
Ping Pong	50	72	15	15

TABLE V

EARLY AND PRESENT WORK PREFERENCES AS REPORTED BY SUCCESSFUL WORKERS IN MACHINE AND ELECTRICAL TRADES

227 Respondents

	During Eighth Grade	Now
Like to Work Best		
Building things	176	75
On small things	169	68
With tools	153	145
On repair work	142	73
On machines	69	135
In a factory	33	98
With my hands	59	45
In doors	57	33
Out of doors	56	33
On electrical things	53	31
In the country	40	46
Like to		
Take care of tools	210	180
Work with my own tools	169	153
Work in a clean place	142	97
Dress nicely	115	69
Keep machines and tools oiled	69	103
Do arithmetic	93	72
Keep clean	90	99
Like to		
Do a good job	176	215
Be on time	172	176
Make money	139	210
Get along with others	136	143
Enjoy working	129	137
Complete work	127	205
Be neat	125	43
Work every day	102	179
Follow directions	98	97
Like to		
Make things work	207	216
Know why things work	183	195
Work on different kinds of things	181	156
Make plans for models	123	42
Experiment	102	205
Do electrical work	101	99
Put things together	99	68
Keep records	67	96
Fix engines and motors	72	92
Like to		
Work with others	185	186
Help other people	179	153
Figure things out	179	160
Make decisions	143	152
Work with things	140	145
Work with people	140	160
Work alone	133	131
Be the leader	92	127

Employment Characteristics of Successful Workers

Employers or supervisors in one hundred and twenty business or industrial organizations employing machine and electrical workers were asked to list those characteristics they thought most necessary for an employee to be successful in the trade.

Each employer or supervisor was interviewed individually, or was provided with the work sheet which would have been used as a structured interview form, if he had been interviewed. The responses of employers and supervisors were recorded on the forms, in both cases, in order to maintain uniformity in recording responses. The interview form or work sheet (pg A-20) was similar in format to that used in obtaining information relative to characteristics of successful students in vocational or trade training programs. In determining the characteristics of successful workers, only the subjective judgments of supervisors were used. Although objective measures might have been applied to the measurement of skill factors or characteristics, time did not permit the application of these measures and the use of these measures in this study was debateable.

Employment in the trade areas being considered in this study is found in both large and small business and industrial organizations. Because of this fact, there was an attempt to gather information from both groups. Information in reference to characteristics of successful workers was obtained from employers and supervisors which employ 10 or under 10 workers, and from those employing 11 or more workers. The two groups were about equally represented. It was hoped that if different characteristics are necessary for success in small shops, those necessary for success in large shops, this would be revealed by the responses from the two groups. An analysis of these responses however seemed to indicate that characteristics necessary for success in large shops

did not differ from those necessary in shops employing fewer than eleven workers.

As in the analysis and tabulation of successful student characteristics, charactertistics deemed necessary for success in machine and electrical trades by employers and supervisors in these areas were grouped under the most appropriate and most inclusive term for the characteristic. Characteristics mentioned by a minimum of ten per cent of those employers and supervisors participating were retained and tabulated. Those which were mentioned by a limited number, or which seemed to be duplications were either eliminated or combined with other related characteristics for the purpose of this tabulation.

Although the open-ended format of the questionnaire used in this study permitted the grouping of desirable characteristics under various headings, the characteristics of successful students as determined by teachers of trade subjects, and the characteristics of workers, suggested by employers and supervisors, were essentially the same. Preferred characteristics of workers in machine and electrical trades as identified under each category or heading by supervisors and employers are listed in Table VI.

Accepted Lists of Characteristics Necessary for Success

As a further step in determining characteristics of those engaged in mechanical and electrical work, standardized instruments, occupational literature and the Counselor's Handbook[12] were studied. Information in reference to the interests and attitudes held by workers in these areas were sought. Factors related to counselor decision making and information and appraisal considerations which may be applied in student selection were also sought for their possible value in the construction of a checklist. Blueprint reading, electricity, gener-

[12] Guidance Counselors Handbook, Washington: U. S. Printing Office, 1953

TABLE VI

PREFERRED CHARACTERISTICS OF WORKERS IN MACHINE AND ELECTRICAL TRADES AS SUGGESTED BY SUPERVISORS AND EMPLOYERS*

Personal Characteristics	
Promptness	118
Honesty	79
Cleanliness	76
Willingness to follow instructions	75
Dependable	46
Devotion to job	42
Social Characteristics	
Ability to work with others	115
Consideration and tolerance	69
Pleasant	63
Sociable	59
Work Characteristics	
Skill	115
Neatness	113
Attention to detail	68
Organization	62
Enjoy work	47
Attitudes	
Friendly	87
Interested	83
Cooperative	79
Receptive	47
Satisfied	43
Interests	
Job oriented	27
Ambitious	22
Temperament	
Calm	85
Pleasant	73
Loyal	13

* 120 Employers participated
2,102 Workers supervised by those participating

al shop, mathematics, mechanics and physics were indicated by most sources used as being of major interest to those employed in mechanical and electrical trades.

Cultural and sociological factors involving the occupational decisions seem to rest in satisfaction in working with electrical and mechanical equipment, and in making this equipment work, in the capacity to reason in terms of mechanical and mathematical principles, and in enjoyment in working with hands, tools and machines. Workers in these areas according to occupational literature seem to enjoy physical activity and moving from place to place while at work.

The most frequently used aptitudes of these workers were said to be in the areas of numerical and special relationships, form perception, motor coordination, and manual and finger dexterity.

Leisure pursuits of mechanical and electrical workers were reported as being in the areas of mechanics and electricity, appliance repair, solving of mechanical problems, and in the collection and construction of mechanical objects.

It was suggested that the social activities of youths who may be interested in these areas are related to such activities as ham radio operation, radio or electricity club membership, and scout radio and electricity merit badge attainment.

Reading, the literature suggests, would include such magazines as Popular Science, Popular Electronics, Mechanics Illustrated and Popular Mechanics.

Sports engaged in, according to the Handbook, would most likely be those requiring enduring strength and agility such as football, gymnastics, hockey, wrestling and hiking.

Further interpretation of the Handbook and other related literature indicates objective, valuative and rigorous temperament roles for workers in these

areas. These workers may be expected to be objective in analyzing machine or electric circuit malfunction, valuative in diagnosing machines malfunction by touch, feel or sound, and rigorous in using measuring instruments and in making precise adjustments. They may also be expected to be adaptable to repetitive work and gregarious in their ability to adapt to group situations.

Format and Content

In establishing the format of the instrument, the study team was guided by the suggestions of administrators, teachers, counselors, and consultants from the field of vocational education, and by the findings of the study team in the investigation of previous related research and literature. Because the checklist or rating scale was finally developed with a value range, and for use in exploratory pre-vocational classes as well as industrial arts classes, the instrument was called the Industrial-Practical Arts Rating Scale (pg. A - 22).

In constructing the industrial arts checklist or rating scale, it was thought that the list should be as short as possible so that it would be economical of time, and simple for the industrial arts teacher to use. It was also thought that it should contain as many of the observable factors or characteristics were determined as a result of the analysis and interpretation of information gained through the various procedures used in this study.

The development of the rating form and profile sheet content was based on the information collected for this purpose and described in this part of the report. The use of this information in the construction of the instrument and in reference to its placement in the instrument, however, was determined with consideration of various factors which normally affect instrument design such as sequence, logical order, grouping, conservation of teacher and counselor time, detailed gradation of marking or rating, pertinence, maximum function as a guidance tool, and various other administrative factors.

Items have been arranged in groupings including personal characteristics, work habits and abilities, and occupational abilities. Personal characteristics include those characteristics which would seem to be necessary for success in all or almost all trade areas. Although physical characteristics of the student are included in this checklist, it is expected that the health record of the student will include details relative to specific health problems which would militate against success in a trade. The work habits and abilities group includes those characteristics which once again would seem pertinent to success in most occupations. Those characteristics listed under occupational abilities are particularly designed to meet employment requirements in industrial occupations. After much discussion throughout the state, it was agreed that these characteristics might also be applied to the evaluation of the individual student in terms of his possible entrance into agricultural as well as industrial occupations. The teacher rating scale provides teachers with detailed descriptions of five possible choices under each characteristics listed. The teacher is required to choose that description which most closely identifies the student in relation to each characteristic. The choices on the scale are graduated from (1) outstanding to (5) poor.

A profile sheet was developed to accompany the rating scale. The profile sheet was intended to present a profile of the students characteristics in terms of weaknesses and strengths in each of the three groups. It was also intended to be produced on transparent material so that the second teacher rating the student might place his profile sheet over the first teacher's profile sheet for the student in order to make note of the areas of growth and areas of need in relation to the students progress from one time period to another. The profile sheet is also intended for use in the periodic rating of the student by the same teacher in order to record growth and detect areas of

weakness. An accumulation of overlays of the profile sheet, it is expected, will provide the guidance counselor with information which will be meaningful in the guidance of the student and in his selection of occupation training.

There was major concern relative to the fact that the selection of characteristics of successful students by teachers of trade subjects would be based on the ability of the student to conform in a classroom situation rather than on the basis of those characteristics necessary for success in actual employment in a particular trade area. There was concern relative to the constantly changing behavior and interest patterns of the adolescent for whom the instruments were being designed. It was the concensus of the study team that these instruments should be used in an on-going program of guidance which would permit the student to make a wise choice in terms of present considerations and yet provide that flexibility necessary for the periodic reassessment of characteristics and for the re-programming of the student in terms of these reassessments, if such re-programming seemed wise.

Possible Uses - Selection, Prediction, Diagnosis, Guidance and Evaluation

The primary purpose of the industrial arts checklist or rating scale and profile sheet was that of providing industrial arts teachers with an instrument which might improve and objectify their judgments in reference to student characteristics, and of providing guidance counselors with additional information which might be used in the selection process.

The rating scale and profile sheet may be also used as a diagnostic instrument early in the training of the student, and at regular intervals throughout the training of a student, for the purpose of determining the areas in which concentrated instruction is needed to foster the growth and development necessary to meet occupational requirements in any occupation or family of occupations.

The individual ratings may be used in both individual and group consultations by counselors and advisors. Adjustment of individual student programs may be made on the basis of strength and weakness indicated on the individual student's profile and profile overlays.

A secondary purpose of the industrial arts checklist may be that of evaluating instruction in industrial arts and pre-vocational exploratory programs through the determination of strength and weaknesses of students in these programs. Its purpose may also be that of determining the nature and extent of change in attitude, comprehension, and knowledge relative to work, and to the completion of assignments in industrial oriented subject areas.

The scope of the rating scale was designed to include attitudes, occupational abilities and work habits necessary for success in machine and electrical trades. It may, however, be applicable to families or clusters of occupations as well.

For the purpose of evaluation, the rating scale may be administered at the end of an industrial arts, pre-vocational, trade training program, or during employment. The use of the scale during employment seems to have definite implications relative to the evaluation of the effectiveness of the trade training program in training the individual to successfully satisfy actual job requirements. Its use would also seem to have implications for the adjustment of the worker to an employment situation after training. The relative effectiveness of one instructional program over another, of broad instructional programs as compared with specific trade training programs, and of various instructional programs as compared with limited or no training in a specific area, may be determined with some degree of objectivity through the use of the rating scale. The reliability of the scale, however, can be established only after extended use.

Experimental Use of the Rating Scale

As a preliminary step in the validation of the rating scale, a pilot study was conducted in eighth and ninth grade industrial arts and pre-vocational exploratory classes in selected schools in urban, and rural areas in New York State.

A junior high school and a senior high school in New York City, three junior high schools in Huntington, Long Island, seven schools in Chemung, Tioga and Schuyler counties, and six schools in Madison and Oneida counties were included in the study. A total sample of 315 students in 18 classes were rated by thirteen teachers.

Analysis and Interpretation of Data

A population of three hundred and fifteen 9th grade students enrolled in industrial arts or pre-vocational education were the subjects of this study. A member of the study team contacted each teacher who was to use the Scale and explained its function and use as a guidance and selection instrument. Teachers were asked to rate students from (1) outstanding to (5) poor, on characteristics listed under the categories; Personal Characteristics, Work Habits and Abilities (General) and Occupational Abilities (Mechanical-Agricultural). The results were then transferred to the Industrial Arts Rating Scale Profile Sheet. When this rating was completed the teacher was asked to determine, by a "yes" or "no" answer, whether the student should be guided toward trade training. He was also asked to suggest an occupational area for each student.

The ratings for each student were tallied to represent his profile score. A frequency distribution of these scores and teachers' evaluations of students in terms of whether or not they should be guided toward trade training are shown in Table VII.

Assuming that the pilot study group was representative of the 9th grade student population the results suggest guidelines for the selection of students

TABLE VII

FREQUENCY DISTRIBUTION OF INDUSTRIAL ARTS CHECK LIST PROFILE SCORES AND TEACHERS' EVALUATION FOR SELECTION FOR TRADE TRAINING

N = 315

PROFILE SCORE	EVALUATION YES	NO	PROFILE SCORE	EVALUATION YES	NO
30-35	3		96-100	20	2
36-40	6		101-105	6	
41-45	11		106-110	11	5
46-50	13		111-115	6	3
51-55	14		116-120	5	8
56-60	19		121-125	3	2
61-65	20	3	126-130		4
66-70	21		131-135	3	3
71-75	26	2	136-140	1	3
76-80	17		141-145	1	4
81-85	13	2	146-150		3
86-90	28	1	151-155		2
91-95	18	1	155-160		2
			TOTAL	265	50

into trade programs by the use of Industrial Arts Checklist profile scores. These guidelines were developed on the b asis of an examination and evaluation of the frequency distribution of student profile scores, and teacher evaluation of student success in trade programs. It appears on the basis of these guidelines that students achieving scores between 30 and 60, sixty-six students or twenty-one per cent of the sample, will be successful in trade programs.

In the profile score range of 61-105 one hundred and sixty-nine students or sixty-two per cent of the sample were evaluated as potentially successful vocational students, while eleven students, or three per cent of the sample, were evaluated as potentially unsuccessful vocational students. It should be noted, however, that a further analysis of the results in this profile score range revealed that eleven students did not follow the pattern which was established by the majority of students. These students, evaluated as potentially unsuccessful, were rated by two teachers. An investigation of the student Profile Sheet for these students, and a comparison with other students in the same profile score range, could not identify a rational for the evaluations assigned. These responses, when compared with the ratings of the other eleven pilot study teachers may be regarded as atypical. It may be hypothesized that the rational for such atypical responses may be external to the Industrial Arts Rating Scale Profile Sheet. If a school, for example, adopts a philosophy that guides the more able students away from the vocational areas, this philosophy would become an external rational for the teacher responding "no" to the question "Should this student be guided toward trade training?" when evaluating the more able student. It is also possible that the teacher rated an able student "no" on the basis of his knowledge of the students occupational

interests. As a result of these atypical responses the question "Should this student be guided toward trade training?" will be revised to "Would this student be successful in trade training?"

If we disregard the atypical responses, students scoring in the profile score range of from 30 to 105, two hundred and thirty-five students or seventy-eight per cent of the pilot study population, will be successful in a trade program.

The profile score range of from 106 to 140 seems to identify a group of students where the prediction of success is questionable. Twenty-nine students or nine per cent of the sample were evaluated as potentially successful while twenty-eight students, or nine per cent were evaluated as potentially unsuccessful. The external rational or school philosophy, previously mentioned, may also have been operating at this profile score level. Further study of the profile score data in this range revealed that the teachers' responsible for atypical responses in the 61-105 range were also responsible for fourteen of the twenty-nine "yes" responses in this range. One of these teachers' did not have a "no" response higher than the 98 profile score rating. This would seem to suggest that the philosophy of his school may direct the less able student into vocational areas. There are enough "yes" responses, in this profile score range, however, to suggest that further follow-up research should be conducted to determine what variable is responsible for judging these students potentially successful despite their profile scores.

This profile score range might be identified as a recounseling range. Students scoring in this range and evaluated as potentially successful should be counseled in an attempt to improve those weaknesses identified through the use of the Checklist. Students evaluated as potentially unsuccessful should be counseled to determine if (1) they can, despite their scores, be successful

in the vocational area of their choice or (2) if they can be directed to an area where their chances of success may be greater.

The profile score range from 141 to 160 seems to identify those students with the least probability of success in vocational areas. The one student evaluated "yes" in this range is a student of one of the teacher previously mentioned, however, any student evaluated "yes" in this range should be exposed to the re-counseling process to determine the variable responsible for the evaluation, and re-evaluate the students' chances of success.

Of the total sample two hundred and sixty-five students, eight-four per cent were rated as potentially successful and fifty students, sixteen per cent were rated potentially unsuccessful.

The results of the teachers recommendation of a trade area for each student were inconclusive. Thirty-six teachers indicated that they could not make such a judgement and suggested that generally their students were at a grade level or age where their vocational interests may not be well differentiated. The contacts with industrial arts teachers in the development and pilot study of the industrial arts teachers rating form seems to confine this theory. When asked to identify a vocational area where a junior high school industrial arts student would be successful the response of the teacher indicated that that judgement was premature because of lack of exposure to industrial areas. It may be that interests in some students are not developed until they have been exposed to, or perhaps enrolled in, a vocational program.

The judgements that were made concerning the teachers' trade recommendations for 24 students,suggested that the successful student in the electrical and machine trade programs would score in the same general profile score range of between 36 to 87. The clustering of profile scores seems to suggest that these two trade areas might be considered similar for purposes of

prediction and selection.

Instrument Evaluation and Refinement

The profile score guidelines established can be useful to the guidance counselor in selecting students for, or predicting success in, vocational education. These guidelines, however have been established on the basis of a small sample pilot study. Although there is no reason to believe that the pilot study sample population was not representative, the results reported here should not be accepted as conclusive. A second phase, or a continuation of this study should involve a substantial sample population for the purpose of establishing valid guidelines for guidance use.

At meetings of guidance counselors, teachers, and administrators who were involved in the pilot-studies, the instruments developed during this first year of the study were reviewed and evaluated. The purpose of this evaluation was that of analysing strengths and weaknesses of the instruments in an attempt to initiate a program of instrument refinement.

The results of the pilot study seem to indicate that in general, the rating scale was an efficient and effective instrument. Although the initial rating of students in terms of the detailed rating scale instructions was time consuming, it was reported that after rating a small number of students, the time required for the rating, using the "profile sheet" was reduced to approximately six minutes per student.

The overall reaction to the use of the Rating Scale and the Profile Sheet was that these instruments could make a meaningful contribution to the improvement of guidance for prospective vocational students. Counselors expressed their general approval of the form in statements such as "The industrial arts sheet will have value both to the industrial arts teacher and the guidance department."

Another counselor expressed his approval of this form with the following

comment. "Having conversed just this A.M. with industrial arts and agricultural teachers, I am sure they would be most pleased to use something of this nature in the seventh, eighth and possible ninth grades." Another expressed his approval by saying that, "The Industrial-Practical Arts Form, I believe, would be most valuable. The parts 1 and 2 appear to have distinct value for other curriculum areas." The contribution to be made by the industrial arts teacher to the guidance profile of the student was expressed by a counselor who said, "I feel both forms would be useful as guidance tools particularly because the industrial arts teacher knows the students at least over a semester's time, while the counselor may be picking up these students at any grade level and often has no familiarity with them." The advisability of using this form repeatedly during different terms of industrial arts was also stressed by the counselors. In referring to the Industrial-Practical Arts Rating Form other counselors merely commented, "Good set - I would like to use this form."

There were suggestions however, which identified areas of concern on the part of participants which might be considered in the refinement of these instruments. The results of the evaluation of the Industrial-Practical Arts Rating Scale and Profile Sheet identified areas for consideration such as:

1. The form should be used by more than one industrial arts teacher in an attempt to eliminate possible biased reporting.

2. Some categories such as Critical self-analysis and creativity are difficult to evaluate.

3. The distinction between any two categories between 1 to 5 is not definite enough.

4. There should be an additional category which will identify those students with serious reading disabilities.

5. There should be a category to identify a students interest in the work area.

6. The format could be simplified by lining up the end of categories with the space for the check or placing it to the left of the question to expedite the rating.

7. The content could be simplified by eliminating overlapping or unnecessary areas.

8. The address and the date of birth seem to be unnecessary information.

9. Because of the lack of student exposure to industrial areas it may be too early to judge whether he will be successful in trade areas.

On reviewing the recommendations for revisions, the study team took the following positions.

1. The intention of the study team is to have the checklist administered by every industrial arts teacher to which the student is exposed using transparent overlays so that a progressive record of student growth is available for counseling purposes.

2. The categories of "Critical Self-Analysis," and "Creativity," were revised. The term "Critical Self-Analysis" was changed to "Self-Criticism." The term "Creativity" was changed to "Innovative Ability."

3. The definition between choices for each item of the Rating Scale itself was not revised. The study team thought that clear distinctions between choices would produce gaps which would result in a similar problem to that of the present problem of overlapping items for the teacher. It was also thought that the difference in total score that one choice would produce over the next best choice would not signigicantly affect the validity of the instrument.

4. The study team determined that another category "Reading Disability," should not be included because reading disability is considered in items such as "The Interpretation of Written Directions or Instructions," and "Accuracy in Making Out Orders and Bills of Material."

5. An Interest category was determined to be unnecessary because of the anticipated use of the Occupational Interest Checklist which is intended for use along with the Rating Scale.

6. The suggestion for changing the format to place responses to the left of the characteristic was rejected because the study team thought the change would be against the conventional tendency to read from left to right.

7. Consideration from areas that seem to overlap will be given in an item analysis which will be undertaken during the continuation of the instrument development.

8. The students address required on the Rating Form was eliminated because it was not considered to be permanent information and was time consuming to enter. The date of birth was determined to be necessary information for purpose of student identification.

9. Suggestions in reference to the difficulty of identifying the successful vocational student cannot be effected by a revision of the Rating Scale and cannot be established until the completion of a longitudal study.

10. The study team decided that the inquiry "Should this student be guided toward trade training?" should be revised to read "Would this student be successful in trade training?" This inquiry was changed to eliminate the possibility of teachers not recommending a student for trade training because he would be capable of success in non-vocational areas.

The Development of a Structured Interview

In addition to the development of an industrial arts checklist it was suggested, during early meetings of vocational educators involved in this study, that a structured interview form be developed for the use of guidance counselors throughout the State. The suggested purpose of the form was that of providing counselors with an interview guide which might be used in obtaining information specifically pertinent to the guidance of the student in his selection of a trade, and in selection of students for trade training by counselors. Such selection is often made necessary because of the number of applicants and limited training facilities.

The lack of research in the area of the structured interview, as previously mentioned in this study, suggested a need for further study of this technique and its usefulness in the selection or prediction process.

Structured Interviews

The analysis of available literature and research relative to patterned interviews as a technique to be explored in this study of the selection and placement processes indicated three major difficulties:

A. The attempts to develop the content of a structured interview led to the inclusion of items similar or identical to those found in published interest inventories. Extension of these efforts would probably result in a new interest inventory which would not differ significantly from those presently available. An attempt to restate the traits described in the Department of Labor Counselor's Handbook, in the form of oral questions, also led to items comparable to those found in established interest inventories.

B. It was conceivable that a new interest inventory could be constructed, standardized and developed for oral administration, just as new

intelligence tests and interest inventories are being continually developed. In order to obtain a satisfactory degree of validity and reliability, it would be essential to follow the practices recommended by the American Psychological Association for the construction of psychological tests and diagnostic techniques. It was questionable whether this could be done within the framework of the present contract, and the time and funds available.

C. Structured interview guides examined by consultants, though developed for use by personnel departments, might be modified for use in school counseling situations. Some interview forms were scoreable and could be validated against some criteria. Most items in these forms however were either factual, calling for information obtainable from application forms, or involved subjective judgment.

The Readiness for Vocational Planning Scales and similar forms have an advantage in that they can be scored and interpreted in terms of the extent to which the examinee is vocationally mature and ready to make an occupational choice. It may be assumed that, given a degree of vocational maturity and adequate occupational information, a student will make a more meaningful occupational decision and will generally prove to be a more highly motivated vocational student. By accepting students at either end of the scale, the effectiveness of the scale to indicate interest, as expressed through motivation, can be observed.

It would seem as though the Readiness for Vocational Planning Scale offers much promise in studies related to prediction and selection. This scale is basically a structured interview with a quantifiable scoring system. It further offers the advantages of comparitive ease of administration. The maximum time limit falls within a normal class period. The scale also offers the added advantage of having preliminary statistical validation work already completed.

Because of the concern expressed by vocational school instructors and administrators relative to the motivation or lack of motivation of students, and because the crucial factor may be the maturity of the student expressing his interest rather than indicated vocational interest it would appear that the experimental use of this scale may provide an innovative approach to the problems of selection.

Among the various findings to date which might indicate RVP's usefulness are:

1. Difference in the results of score sets collected in 1958 and 1961, "were in directions assumed to indicate increased readiness for planning or vocational maturity", Gribbons and Lohnes (1964, p. 19).[13]
2. "The multi-dimensional personal interview administered to 110 boys and girls in the eighth and tenth grades has demonstrated, under statistical analysis, its ability to separate these boys and girls into three curricular groupings: College Preparatory, Business, and Industrial Arts and General; and to predict with some validity as early as the eight grade the curriculum in which a youngster will be in at high school," Gribbons and Lohnes (1964, p.24).[14]
3. "The Readiness For Vocational Planning scale scores based on the eighth grade interviews conducted seven years later when the subjects are two years out of high school." Gribbons and Lohnes (1967, p. 26).[15]

[13] Gribbons and Lohnes, (1964) loc. cit. p. 19.

[14] Gribbons and Lohnes, (1964) loc. cit. p. 24.

[15] Gribbons and Lohnes, (1967) loc. cit. p.26.

Other forms examined represented a generalized format which did not lend itself to quantification and could only be evaluated through use or lack of use. A further implication of the study of structured interview forms was that techniques for conducting counseling interviews are presumably part of the preparation of guidance personnel and that they should be administered by guidance personnel.

The method used in the standardization of scales examined appeared to be that of an analysis of adult interests in specific trade or occupational areas. This is the usual technique for the standardization of an inventory. It does not, however, represent the complete development of the standardization because it is then necessary to apply the scale to pre-vocational youth to determine the relationship of the inventory to their interests.

The card sort technique represents another form of structured generalized interview. The use of a card sort technique appears to permit a less directive guidance approach. To measure the benefit of this technique, it would be necessary to introduce this approach in several sending schools and, through a longitudinal study, observe whether the students making occupational choices through this technique prove to be more highly motivated in their vocational courses than other students. Another possible approach would be that of noting the patterns of the occupational title card sort of successful and failing students in specific vocational programs. Students not choosing these occupations might be used as a control group. If a differential exists in the pattern of card sorting and ranking these could then be assumed to provide some differential prediction of interest. Further application would entail application and pattern analysis for pre-vocational students, to be followed in a longitudinal study.

This latter technique could be applied to a card sort of either occupational

values or job titles. It should be noted, however, that these investigations would require factor analysis in order to observe whether clusters of values, or of job titles, exist which correlate with specific interest.

Interest inventories have been widely used in counseling students and directing them to areas where their interests lie. However, the review of literature on the use of interest inventories such as Kuder Preference Record and the Strong Vocational Interest Blank in predicting student success in vocational areas have generally produced inconclusive results. Studies reported in Section 1 such as Cooper (1954),[16] Samuelson (1958),[17] Motto (1959),[18] and Lowman (1967)[19] suggest that at best the interest inventory has limited usefulness as a predictor of vocational success and is not reliable in differentiating between successful and unsuccessful vocational students.

The findings in project MINI-SCORE[20] thus far suggest that individuals in trade and industrial curricular are similar on many dimensions. They have similar needs, interests, abilities, and personalities, as defined by the instruments used in the project. This does not mean that they are identical.

On the basis of this project it appears that certain jobs appeal to persons with similar personal characteristics. It has been possible on the basis of data obtained in this study thus far to empirically cluster jobs, in terms of the characteristics of persons training for them. Such a finding, with the large number of variables used in the study, could have direct and significant implications for vocational counseling procedures. These findings seem to be meaningful in sophisticated testing programs. A further implication of these findings would seem to be that, in a situation where practical

[16] Cooper, loc. cit.

[17] Samuelson, loc. cit.

[18] Motto, loc. cit.

[19] Lowman, loc. cit.

[20] Pucel and Nelson, loc. cit.

limitations prevent the use of sophisticated instruments, and where the student population is of pre-high schoolage, less sophisticated instruments measuring interests and needs be constructed. These instruments could be used in the development of an objective yet flexible and continuing system of student evaluation and selection.

Preliminary Development Procedures

In the preliminary development of an interview form both an interview form and card sort "set" were constructed, using information gained through a study of literature, available structured interview forms, and the recommendations and suggestions gained through the action research techniques used in the study.

In the initial development of a structured interview, questions which might be asked by guidance counselors, in order to objectify interviews with students with possible interest in trade training, were formulated and listed in groups. These groups were arranged in order relative to those interest areas which were likely to be general in nature and progressing to those interest areas which would seem to have direct bearing on the selection of a trade or occupation.

In preliminary trials in two schools, where over 150 students were interviewed, the efficient administration of the structured interview necessitated twenty minutes per student.

After extended discussions with guidance counselors from various parts of the State, it was decided that the structured interview form which had been developed might, because of the counseling load of guidance counselors, also be used by industrial arts teachers rather than by counselors alone.

There was some disagreement, however, on the administration of such a technique by teachers of industrial arts. Although many vocational educators agreed that the structured interview should be administered by the guidance counselor or the industrial arts teacher, it was decided by the study team that the guidance counselor, being trained in interview technique and established in this role with students, was the one who should administer the structured interview.

During further meetings with guidance counselors throughout the State, it became questionable whether there would be sufficient guidance counselor time available to administer a structured interview to every prospective vocational student.

In an attempt to determine a workable format, a card-sort technique was the object of a pilot study involving eight ninth-grade classes or a total sample population of two-hundred students. At the conclusion of the pilot study, the guidance counselor and teachers involved agreed that the data gathered by the card-sort technique could have been gathered more efficiently by some other method.

After further consultation with counselors, teachers of trade subjects, and teachers of industrial arts, it was suggested that an experimental combination structured interview form and occupational interest inventory be developed and used in order to obtain information which the study team identified as pertinent to the selection of students for trade training. An examination of existing occupational interest inventories revealed the existence of subject matter extraneous to the guidance of students with specific reference to industrial occupations and specifically to machine and electrical trades. Further examination of existing forms revealed that sentence structure and wording were in several instances above the reading level of many eighth

and ninth grade students, and in some cases were difficult for students on the eighth grade level with normal reading ability to interpret.

Some existing forms which have relationship to this study such as the Minnesota Vocational Interest Inventory were designed to determine the effects of students' interests on their choice and adjustment to trade training programs and later vocations.[21] Although the purpose of this inventory was similar to that of the purpose of the instrument developed in this study, it was intended for guidance after entrance to trade training, rather than as an instrument to be used in the selection or prediction of students' success before entrance into trade training programs.

A recommended alternative to the use of existing forms was the development of a new experimental form which could be used as a structure which an interview could follow, or as a self-administered instrument to be completed by individual students or small or large groups of students and administered by either a teacher or guidance counselor. The form was designed as an interest record which could be used as a "spring board" in counseling or as part of the student's cumulative record for the purpose of providing evidence of interests for use in counseling and in the selection process. With this objective determined, an experimental Occupational Interest Check List was developed. In designing the instrument, other interest forms wuch as the Kuder Vocational Prederence Record, Strong Vocational Interest Blank, Gordon Occupational Check List, and the Survey of Interpersonal Values were reviewed in terms of their possible relationship in reference to format and content, to the new form.

21 W. Leslie Barnette, and John N. McCall, Validation of the Minesota Vocational Institute Inventory for Vocational High School Boys, State University of New York, Buffalo 1963.

Format and Content

The format of the instrument was determined on the basis of available information relative to the design and use of interest inventories, the suggestions and recommendations of those who would use the instrument, and the administrative limits placed on the use of psychometrics by factors relative to normal school operation.

The content of the instrument was determined and arranged so that it would be:

1. Attractive, interesting, appealing and simple
2. Understandable and readable by eighth grade students having normal or slightly below normal reading ability.
3. Grouped in logical order in relation to interests and backgrounds of eighth grade students.
4. Composed of interest items which have been determined as bring related to success in machine and electrical trades.
5. Short to permit the economical use of time for administration.
6. Designed to obtain only items of information which could not be obtained from other records in the student's cumulative folder.

In order to satisfy these demands in the design of the experimental instrument, interests were grouped in sections and accompanied by illustrations which, it was believed were not generally associated with testing and which would suggest the general areas of interests represented by the sections. Groupings or sections were arranged so that the first group of items to be checked by the student would include those items (school subjects) which are general in nature and which would be familiar to all students, and capable of being selected by almost all students without difficulty. The sequence of sections was arranged to progress from general groups to those groups which

seem to be pertinent to occupational purpose, interest, and attitudes.

The content of the form was designed to include those items which were indicated as being indicative of success in machine and electrical trades by teachers of trade subjects, and workers, employers of workers,and in literature having to do with occupational requirements for success in these areas.

In consideration of reading difficulties encountered by many eighth grade students, an effort was made to eliminate the use of sentences in the experimental form. Single word choices were used where a single word seemed to describe the interest to be offered for selections. Words used were in most cases, within the reading ability range of sixth grade readers. Preliminary trial use of the form, to test its readability, indicated that its use in a pilot study would be feasible.

The grouping of interests with reference to the background of students seemed to provide a simple way for students to begin checking off their interests and preferences. No student seemed to be confused at any point in the use of the form.

The grouping of interests and preferences into ten sections each related to an interest area, provided a form which was short enough to require only six minutes for the majority of students to complete.

The form was designed to be administered with ease, and in a short period of time. It was found that it was suggicient to merely give a form to a student, or to a group of students, and to give the instruction "Check the five things you like best in each of the boxes".

Choices, or items, offered to students were determined on the basis of information gathered in this study relative to the interests and characteristics of successful workers in the machine and electrical trades. The experimental form appears in the appendix of the study (p. A-31).

Experimental Use of the Occupational Interest Checklist

As a preliminary step in the validation of the Occupational Interest Checklist, a pilot study was conducted in eighth and ninth grade industrial arts and pre-vocational exploratory classes in selected schools in urban and rural areas of New York State.

A junior high school and a senior high school in New York City, seven schools in Chemung, Tioga and Schuyler counties, and six schools in Madison and Oneida counties were included in the study. A total sample of 221 students in 15 classes were involved in the pilot study. A member of the study team contacted each teacher participating in the administration of the Check List and explained its function and use as an instrument for guidance, selection and prediction. Teachers were asked to distribute the forms to both individual students and to large and small groups of students for the purpose of discovering problems that may occur during the administration of the forms with either individual students or groups. Teachers were also asked to evaluate the form structure, illustrations used, and readability.

Analysis and Interpretation of Data

Each of the items in the ten groupings were assigned values relative to the frequency with which it appeared in lists of successful characteristics of students and workers, obtained as a result of research in the original planning and design of the instrument. Items which matched those characteristics, or interests of successful students and/or workers most frequently identified by those previously surveyed were given a value of five (5). Those interests of characteristics which were in evidence as characteristics or interests of successful students or workers, but which were not as frequently listed as others (See Table IV and V) were given a value of three (3)

Characteristics which had little or no relationship to success on the basis of their infrequent listing in the survey previously mentioned were given a value of one (1). A maximum score of 250 or a minimum score of 78 could be achieved on the checklist if five (5) items in each of the characteristic or interest groupings were checked. The results are shown in Table VIII.

Because it was believed that students would check only major interests, the pilot study sample was not instructed to check five and only five items under each category. As a result some students checking fewer than five items, scored lower than the expected minimum of 78. Others, checking more than five items, the study team decided, would be scored only on the five highest scoring items checked. On the basis of expectancy, these scores would be higher than they might have been if only five choices were made originally. The Check List will be revised to include instructions to students to check five items in each group.

The Check List will also be revised to include an evaluation of the student by the teacher similar to that at the end of the Rating Scale, "Would this student be successful in trade training?" The purpose of this evaluation will be that of providing a basis for the determination of score ranges which may be used to identify students who may be potentially successful, students whose success is questionable, and those students who have little chance for success in trade training.

The study team was aware of the limitations of the instrument in its initial form, and the possibility of results being skewed because of them. It was however, decided that guidelines, based on the assumption that the sample population scores were normally distributed, should be determined. If a normal distribution is assumed, scores from 236 to 250 will identify those students who will be "most successful" in trade training. Scores of 196 to

TABLE VIII

FREQUENCY DISTRIBUTION OF OCCUPATIONAL INTEREST CHECK LIST SCORES

N = 221

SCORE	N	SCORE	N
5 - 15	2	126-135	20
16-25	1	136-145	13
26-35	2	146-155	13
36-45	1	156-165	16
46-55	3	166-175	21
56-65	1	176-185	17
66-75	2	186-195	7
76-85	12	196-205	5
86-95	7	206-215	10
96-105	13	216-225	10
106-115	15	226-235	4
116-125	22	236-245	4

235 will identify those students who have "above average" potential for success in trade training. Scores of 106 to 196 will identify those students who have "average" potential for success in trade training. On the basis of this assumption, students scoring below 106 would seem to have "below-average" potential for success in trade training. For the purpose of this study, students scoring below the score of 78 were not considered further.

It appears that any student scoring below 106 should be directed for re-counseling to determine if, despite his low scores, he can be successful in vocational areas, or to redirect the student to areas where his chances of success may be greater.

Instrument Evaluation and Refinement

As a further step in the development of the instruments, the study team suggests that the inter-correlation of the Rating Scale and the Checklist be determined. If the inter-correlation is significantly high, consideration should be given to further revisions or to eliminating one of the instruments. Low inter-correlation, however would seem to indicate that the instruments are measuring different aspects of those qualities or characteristics which appear to determine the success or failure in trade training program.

The Occupational Interest Checklist might be used as a re-counseling instrument to differentiate between potentially successful and unsuccessful students who score in the "questionable" profile score range of the Industrial Arts Check List. Using the checklist in this way may serve to reduce the guidance counselor time in re-counseling. The instrument will also provide an additional measure to further objectify the counseling process.

Comments of guidance counselors relative to the use of the occupational interest check list were, in general, supportive of its use in determining student interests, both as an interview form and, as a check list to be used

by the students. One counselor stated, "I think I would use the multiple page form as an individualized interview form, probably orally." Another commented, "I can see where this form would be helpful to me as a counselor." A third counselor said, "I feel that as a completed study, where we have some norms to go by, the occupational form may have some value." Others said, "The occupational interest check list seems to overlap information we already have but has value." The general use of the occupational check list was expressed by one counselor who said, "I can see some use of this form when used in a total picture of the student. It would give us as counselors another tool to assist students in making a vocational or occupational choice."

The results of the evaluation of the Occupational Interest Check List identified areas for further consideration. These areas included the:

1 Improvement of the quality of the drawings illustrating each category.

2 Illustration of each category with four drawings rather than one which may be suggestive of a particular response.

3. Possible revision of what the student "likes" to what the student is "good in".

4. Possible addition of an "other" category should be added to each group of items.

5. Possible revision of the check list to be oriented to both sexes.

6. Establishment of categories for checking a student's physical ability and disability.

7. Addition of instructions to the form. Students should be advised to select five items in each grouping.

8. Addition of a teacher evaluation of the student in relation to his possible success in trade training.

The questions raised were discussed by the study team and resolved in the following manner:

1. The revised instrument, to be used in a continuation of this study, would contain refined illustrations to accompany each category.

2. A revision of the illustrations to include four drawings rather than one was rejected by the study team. It was thought that four drawings might be distracting. The illustrations will be studied and revised to remove material that is suggestive of a particular response.

3. The suggestion of revising the Checklist to consider what the student is "good in" rather than what the student "likes" was rejected. The study team decided that information on what the student is "good in" will be gathered through the use of the Rating Scale while the "likes" of students gained through the Interest Checklist will provide a profile of student interests.

4. The "other" category was designed to allow for an open-ended student response in an attempt to determine any interest patterns based on frequency of response, that would identify areas which should receive consideration for the inclusion in the instrument. For the purpose of pilot studies the "other" category will be included. For the purpose of the final study the revised instrument will not contain an "other" category.

5. The Checklist was designed primarily to be used to predict success in the selection of students for training for the machine and electrical trades. As such, the instrument was designed for the male student. If consideration is given to the use of the instrument for general prediction, two test formats could be used; one male and the other female oriented.

6. The study team did not consider the inclusion of physical abilities and disabilities categories necessary. These items are included in the Industrial Arts Rating Scale. It is also assumed that physical disability is covered in school physical and health records of students.

7. On the recommendation of the study team, the Checklist will be revised to include instructions to students to select five, and only five items in each grouping.

8. On the recommendation of the study team the Checklist will be will be revised to include an evaluation, similar to that on the Rating Scale Profile Sheet, relative to the students success in a trade training program.

Summary and Conclusions

After a complete and comprehensive review of literature and research dealing with prediction of student success and the selection of student for trade training program it seems evident that the use of certain standardized tests, or revisions of these tests, may be meaningful as a factor in the prediction of student success but that this approach should not be used as a sole guide or determinant.

The study of successful workers and selection techniques used in education and industry seems to indicate that non-cognitive, or behavioral characteristics of workers, are not only important to success but may be determining factors. As possible determining factors these characteristics must be considered in conjunction with scores achieved on standardized tests and other factors which have been shown to have meaningful correlation with success in various trade areas. To be used as an efficient guidance tool it is reasonable to conclude that the measurement of non-cognitives should be structured and objectified.

Opinions of teachers, supervisors, administrators, and other specialists in the field of vocational education and guidance indicate a definite interest in the development of techniques for the prediction of student success for purpose of selection. There seems to be general agreement that prediction and selection should take place at the eighth or ninth grade level and that it should be based on several determinants so that non-cognitive as well as cognitive characteristics of the student may be considered in the selection process.

As a result of meetings conducted during this study it may be concluded that to be functional in the educative process in New York State at the present time, the measurement of students for the purpose of prediction and

selection should be planned for administration during short time periods and administrative efficiency.

Similarity of interests of eighth and ninth grade students who appear to meet those criteria deemed necessary for success in the machine and electrical trades, and the apparently limited backgrounds of these students, would seem to indicate that prediction at this grade level for a specific trade area rather than for a family or cluster of trades and additional exploratory experiences is unwise.

Because of the interest of education in providing opportunity for trade training to all students who would be able to benefit as a result of such training, it was concluded that testing materials must be developed or adjusted for use with students with limited reading ability.

Outcomes of the Study

As a result of this study an investigation of standardized testing as used in prediction and selection, which can be used as a basis for a testing program in New York State has been made.

The literature and research that has been reviewed, the data gathered on the characteristic of successful students and workers, and the instruments developed will provide a base from which further study can be undertaken.

This study has resulted in the development of an experimental Industrial Arts Rating Scale and Profile Sheet which seems to be usable as a selection instrument in its present form. It has also resulted in the development of an Interest Checklist which, with some adjustment can be used on eighth or ninth grade levels, either as an interest inventory or as a structured interview guide. Both of these forms however need further experimentation and standardization.

As a result of this study a complete and comprehensive biblography for selection and prediction has been developed. The advantages of the availability of this biblography in the further development of a program of selection and research is obvious.

Meetings conducted in various parts of the States relative to the experimental use and evaluation of instruments have resulted in an intensified interest and an awareness with regard to selection and prediction procedures.

It is recommended that this study be continued for the purpose of developing a program of student selection for trade training programs based on:

a battery of short and specially adjusted and adapted standized tests related to those knowledges and aptitudes for which high correlations with success in previous experimental batteries has been indicated.

an objectified teacher evaluation of the student in terms of those personal and behavioral characteristics which have been established as being necessary for success in trade training and employment.

an inventory of student interests and preferences which have been identified with success in trade training and employment.

an evaluation of the student in reference to scholastic record.

an evaluation of the student in reference to health record.

R E C O M M E N D A T I O N S

On the basis of one year of study, the review of related literature and research, the evaluations and comments of the teachers, administrators, and guidance counselors, the evaluation and comments of the executive, advisory, and planning action committee, and special consultants, the research team listed the following recommendations for further study.

1. A continued program of instrument refinement should be followed through repeated field tests throughout the state.

2. An item analysis of the instruments developed should be conducted to identify intercorrelated and unnecessary items.

3. A longitudinal study should be conducted to determine the validity and reliability of the instruments developed.

4. An inter-correlation of the instruments developed should be undertaken to determine if the instruments are measuring separate factors of the qualities and characteristics necessary for success in vocational areas.

5. An investigation should be conducted to determine the feasibility of modifying the reading level and content of existing standardized instruments, such as the GATB, to a sixth grade level to make them applicable to 8th and 9th grade selection procedures.

6. A study of the usefulness of the General Aptitude Test Battery in its present form and a modified form, for pre-vocational use, in the selection process, should be undertaken.

7. A study of student cumulative records should be conducted to determine common state or area measures which might be useful additions to a test battery.

8. A longitudinal study should be conducted to determine if the students identified as successful vocational students, by the instruments developed in this study are also identified as successful workers by their employers.

9. A study of the use of re-counseling scores in the selection procedure should be conducted.

10. An investigation of the vocational student drop-out should be conducted in an attempt to isolate and identify variables associated with the drop-out.

11. An investigation of students initially identified as unsuccessful who became "successful" should be conducted to identify the variables responsible for his success.

12. Students identified as having an approximately equal probability of being successful or unsuccessful should be studied in an attempt at isolating variables that are responsible for their eventual placement.

13. An in-depth study of existing industrial employee selection practices should be conducted.

14. An intensive study of industrial literature on employee selection and the prediction of employee success should be made.

15. A comprehensive survey of existing educational practices of student selection for vocational areas should be conducted.

16. A review and evaluation of the research literature on selection and prediction from 1920 to the present should be undertaken in an attempt to identify trends in the selection process.

17. A study should be conducted to determine the role of motivation in determining the successful student.

18. An investigation should be undertaken to evaluate the role of maturity in determining the successful student.

19. Studies should be conducted to determine the role of job satisfaction in determining eventual success.

20. A study should be undertaken on the role of guidance counselor-student relationships in determining student success.

21. An investigation should be undertaken to determine if there are specific student characteristics that can be isolated and used to differentiate between successful student in different trade areas.

22. A study should be undertaken to determine if trade areas can be identified as clusters for the purpose of selection.

23. An investigation should be conducted to explore the possibility of increasing the predictive validity of predictor instruments by adjusting scores on the basis of variables identified as having an effect on the success of vocational students.

24. An investigation of the possibilities of developing and introducing New York State standards in industrial arts and vocational education in an attempt to stabilize school grades as a criterion measure of success should be conducted.

25. Experimentation with pre-vocational exploratory courses should be conducted to determine their usefulness as tools of guidance.

26. An investigation of drop-outs and those not accepted in the vocational program should be undertaken to determine curriculum and occupational areas that will offer them a chance to succeed.

27. A study of the existing data gathered in the schools of New York State should be conducted to explore the possibility of standardizing tests given throughout the state so that the establishment of a data bank for future computer use can be facilitated.

28. An investigation of computer assisted guidance systems and their implementation should be undertaken in anticipation of their possible use in New York State.

29. A study should be conducted to determine the extent to which the philosophy of the New York State Department of Occupational Education is implemented.

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The following bibliography is composed of materials that had particular relevance to the objectives of this study and of materials that had relevance to the selection of students and prediction of success in vocational education. In addition to its pertinence to this study it is hoped that this bibliography will provide researchers, vocational educators, administrators, and guidance personnel with a comprehensive listing of materials that might prove to be a valuable resource in relation to student selection, prediction of success, the measurement and appraisal of competencies, and continued research in this area.

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APPENDIX

APPENDIX

New York University Study Team

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NEW YORK STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION RESEARCH

NEW YORK UNIVERSITY
School of Education

New York State Predictive Testing Study

The Selection of Students for Entrance into Trade Programs in Public Secondary Vocational Schools

Work Sheet

The purpose of this study is one of developing a predictive instrument or instruments which may be used effectively with ease of administration and efficiency. The development of such an instrument may require an entirely new approach to prediction and the format of predictive instruments. Please express any ideas on prediction and instrument content, format, and administration, which the following questionnaire may suggest, and which may lead to the development of a broad comprehensive, yet short and workable tool for use in pupil placement in vocational-occupational training programs.

Content

Predictive instruments should contain questions which would reveal the following personality traits:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive Instruments should contain questions which would reveal the following character traits:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive instruments should contain questions which reveal the following personal characteristics, habits, or attributes:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive instruments should contain questions which reveal ability in the following areas of knowledge:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive instruments should contain questions which would reveal interests in:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive instruments should contain questions which would reveal aptitudes for:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Predictive instruments should be designed

for non-readers _____

for reading grades 7 - 8 _____

for reading grades 8 - 9 _____

for reading grades 9 - 10 _____

other format or level _____

Explain: _____

_____

_____

Administration and Administrative procedures

Predictive instrument should be designed to be administered to students in groups of:

_____

_____

_____

Predictive instruments should be designed for students on grade level:

_____

_____

_____

Predictive instruments should be designed to be administered in a time period of approximately:

_____

_____

_____

A-6

Predictive instruments in Vocational-Occupational education should be designed to

a. Predict for a single vocational subject area

b. Predict for a group of related areas

c. Provide a broad profile to be used in prediction and placement

d. _____

_____

_____

e. _____

_____

_____

Format

Predictive instruments should be designed as

a. tests to be administered to all entering students _____

b. tests to be administered to all students seeking entrance _____

c. check lists to be used by counselors and teachers during grades 7 through 9 _____

d. Questionnaires or interest inventories to be filled out by students seeking admission _____

e. a combination of above _____

f. _____ _____

g. _____ _____

h. _____ _____

i. _____ _____

STATES AND CITIES CONTACTED RELATIVE TO SELECTION POLICIES AND PRACTICES

STATES	CITIES		
Alabama*	Montgomery	Birmingham	
Alaska*	Fairbanks	Juneau	Anchorage
Arizona*	Phoenix		
Arkansas	Little Rock		
California	Sacramento*	San Francisco	Los Angeles
Connecticut*	Hartford	Bridgeport	Stanford
Colorado*	Denver*		
Delaware*	Dover		
District of Columbia*			
Florida	Miami*	Tallahassee	
Georgia*	Atlanta		
Hawaii	Honolulu		
Idaho	Boise		
Illinois*	Chicago*	Springfield	
Indiana*	Indianapolis	Versailles	
Iowa	Des Moines*		
Kansas	Kansas City*	Topeka	
Kentucky	Louisville	Frankfort	
Louisiana	New Orleans*	Baton Rouge	
Maine*	Bangor*		
Maryland	Baltimore		
Massachusetts	Boston*	Cambridge	
Michigan	Detroit*	Flint*	Lansing
Minnesota	St. Paul	Minneapolis	
Mississippi	Jackson		
Missouri	St. Louis*	Jefferson City	
Montana	Helena		
Nebraska	Omaha	Lincoln	
Nevada	Carson City		
New Hampshire*	Concord		
New Jersey*	Trenton*	Newark	Jersey City
New Mexico	Alburquerque		
New York*	New York*	Utica*	Syracuse*
North Carolina	Raleigh	Charlotte	
North Dakota*	Bismarck		
Ohio	Dayton*	Akron*	Columbus
Oklahoma	Oklahoma City*		
Oregon	Portland		
Pennsylvania	Pittsburgh*	Philadelphia*	Harrisburgh
Rhode Island*	Providence*		
South Carolina*	Columbia		
South Dakota	Pierre		
Tennesse	Nashville*	Memphis*	
Texas	San Antonio*	Dallas*	Houston
Utah	Salt Lake City*		
Vermont*	Montpelier		
Virginia*	Richmond*	Norfolk*	
Washington	Seattle*	Olympia*	
West Virginia	Charleston		
Wisconsin	Milwaukee	Madison	
Wyoming			

* Responding States and Cities

NEW YORK UNIVERSITY
School of Education
WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-3356

Department of Vocational Education

Dear

New York University, in conjunction with the State of New York and the State of Connecticut, has engaged in studies of the value of predictive testing in certain areas of vocational education. As part of this study, we are attempting tc gather information relative to predictive testing programs and screening programs for entering vocational education students in major vocational education programs throughout the country.

If it would be possible for you to send us information relative to predictive testing or screening in the area of vocational education in your schools, we shall be grateful for the contribution that you will be making to this study.

As a result of the studies that we are undertaking, it is hoped that a predictive instrument will be developed that will be effective and efficient as a guidance instrument not only in New York State, but in vocational programs throughout the country. Thank you for your help and cooperation.

Sincerely,

William R. Grieve
Professor of Education
Director, New York State Study on Predictive Testing

WRG:ps

NEW YORK UNIVERSITY
School of Education
WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-3356

Department of Vocational Education

Dear

New York University, in conjunction with the State of New York and the State of Connecticut, has engaged in studies of the value of predictive testing in certain areas of vocational education. As part of this study, we are attempting to gather information relative to predictive testing programs and screening programs for entering vocational education students in major vocational education programs throughout the country.

A short time ago, the New York University Study Team sent letters to each of the states and major cities requesting this information. At the present time we have not received an answer from you with reference to your selection program.

If it would be possible for you to send us information relative to predictive testing or screening in the area of vocational education in your schools, we shall be grateful for the contribution that you will bemaking to this study.

As a result of the studies that we are undertaking, it is hoped that a predictive instrument will be developed that will be effective and efficient as a guidance instrument not only in New York State, but in vocational programs throughout the country. Thank you for your help and cooperation.

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NEW YORK UNIVERSITY
School of Education
WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-3356

Department of Vocational Education

Director of Personnel
Department of Personnel

Dear Sir:

New York University, in connection with the State of New York and the State of Connecticut, has engaged in studies of the value of predictive testing in certain areas of vocational and occupational education. As part of this study, we are attempting to gather information relative to the selection of personnel in trade areas in various industries and industrial plants throughout the country.

We are also endeavoring to ascertain the correlation of the results obtained on tests used for employment processes or screening of applicants and success in actual job performance.

If it would be possible for you to send information relative to your methods of employee selection or screening, the names of any tests that you may have been using and any statistical reports that you may have on the use of these tests we would be grateful. If it would be feasible for you to send copies of any tests, scales, or inventories used as selection instruments, these would be greatly appreciated and would be held in strictest confidence.

As a result of the studies that we are undertaking, it is hoped that a selection instrument will be developed in one of our present studies that will be effective and efficient as a guidance and selection instrument for use in schools and in industry.

Thank you for your help and cooperation and for any contribution of information that you may make to the development of our study.

Sincerely,

William R. Grieve
Professor of Education
Director, New York State Study on Predictive Testing

WRG:ps

NEW YORK UNIVERSITY
School of Education
WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-3356

Department of Vocational Education

June 21, 1968

Director of Personnel
Department of Personnel

Dear Sir:

We are undertaking a study of methods of selecting individuals for various occupational positions. A short time ago major industries throughout the country were asked to provide information relative to programs of selection that were being used.

Information relative to this need not be extensive but should indicate the type of selection methods used or a statement relative to the policies employed in the placement of individuals in various occupational positions.

If it would be possible for the research team of New York University to receive this information, it would facilitate information needed in the New York State Study on Predictive Testing. I shall be grateful for any help that you can provide. Best wishes for a fine summer.

Yours truly,

William R. Grieve
Professor of Education
Director, N. Y. State Testing Study

WRG:ps

NEW YORK UNIVERSITY
School of Education
WASHINGTON SQUARE, NEW YORK, N.Y. 10003
AREA 212 598-3356

Department of Vocational Education

June 21, 1968

The New York State Education Department has undertaken the development of an experimental program of the prediction of success in vocational programs on the high school level. New York University is working with the State Education Department in the development of an experimental program. At a recent series of meetings of teachers, and administrators of vocational education, it was suggested that check lists be developed for the use of industrial arts teachers rating those characteristics which may be meaningful in the guidance of students toward profitable programs of vocational education.

In order to develop these lists in terms of the students with whom they are to be used, it was decided by the research team that it will be necessary for vocational teachers to identify students who have been successful in their classes and to list the characteristics observed in these successful students. Such a listing, it is believed, could provide clues for the development of a meaningful check list.

If it will be possible for you to list those characteristics which are evidenced by your successful students, I am certain that the resulting list will be of extreme value. The listings of characteristics should include:

1. Personal characteristics of successful students.
2. Social characteristics of successful students.
3. Attitudes of successful students.
4. Interest patterns of successful students.
5. Characteristics of temperament of successful students.
6. Other characteristics of successful students.

The groups present at the meetings and those involved in the development of the testing program have also planned on the measurement and appraisal of work characteristics and extent of skill. If you could send me such a list of characteristics dealing with only those characteristics listed on the first page however, within the next few weeks, I would be most grateful. I am enclosing a form which may be of help in providing this information. I shall keep you informed relative to the development of the project as we progress. Best regards.

Sincerely,

William R. Grieve
Director
New York State Study

WRG:ps
Enc.

NEW YORK STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION RESEARCH

NEW YORK UNIVERSITY
School of Education

New York State Predictive Testing Study

Successful Student Characteristics

Personal _____

_____

_____

_____

_____

Social _____

_____

_____

_____

_____

Attitudes _____

_____

_____

_____

_____

Interest Patterns

Temperament

Other

Name _____ Trade _____ Yrs. in Job ___ No. of Pay Raises____

NEW YORK STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION RESEARCH

NEW YORK STATE PREDICTIVE TESTING STUDY

Instructions: We are trying to find out what workers who are successful in their trades were like when they were in the eighth grade and to find out what they are like today. Pupils who do not follow a traditional "student" pattern in most cases become successful adults. Please let us know exactly what you were like when you were in the eighth grade. Your careful answers to these questions may help us to help youngsters who are very much like present day workers were in their early school days.

Please try to remember what you were like "THEN" (when you were in the eighth grade) when you check the "Yes" or "No" in the "THEN" column. Answer the "THEN" column first.

Please check the "Yes" or the "No" column under "NOW" to tell us exactly how you are now. Your answers will be kept in strictest confidence.

NOTE: Answer all "THEN" Columns First

PART I

PERSONAL CHARACTERISTICS

Characteristic	THEN (as shown in school)		NOW	
	YES	NO	YES	NO
Trustworthy	___	___	___	___
Dependable	___	___	___	___
Helpful	___	___	___	___
Friendly	___	___	___	___
Courteous	___	___	___	___
Respectful	___	___	___	___
Cooperative	___	___	___	___
Obedient	___	___	___	___
Responsible	___	___	___	___
Self Controlled	___	___	___	___
Patient	___	___	___	___
Accepts criticism	___	___	___	___
Even tempered	___	___	___	___
Cheerful	___	___	___	___
Neat	___	___	___	___
Clean worker	___	___	___	___
Fashionable	___	___	___	___
Hard working	___	___	___	___
Punctual	___	___	___	___
Good attendance	___	___	___	___

PART II

FAVORITE SUBJECTS

	THEN	NOW		THEN	NOW
English	___	___	Industrial Arts	___	___
History	___	___	Home Economics	___	___
Mathematics	___	___	Music	___	___
Science	___	___	Health Education	___	___
Language	___	___	Other	___	___

FAVORITE HOBBIES

Art Work	___	___	Radio Repair	___	___
Ceramics	___	___	Fixing Things	___	___
Metal Work	___	___	Collecting	___	___
Wood Work	___	___	Automobile Work	___	___
Stamp Collecting	___	___	Machine Work	___	___
Jig Saw Puzzles	___	___	Hiking	___	___
Travel	___	___	Gardening	___	___
Making Things	___	___	Hunting	___	___
			Fishing	___	___

FAVORITE GAMES

Cards	___	___	Ping Pong	___	___
Checkers	___	___	Monopoly	___	___
Jig Saw Puzzles	___	___	Word Games	___	___
Chess	___	___			
Pool	___	___			

FAVORITE MAGAZINE

Sports	___	___	Scouting	___	___
Mechanics	___	___	Automobile	___	___
Travel	___	___	Gardening	___	___
Movies	___	___	Machinery	___	___
Science	___	___	Westerns	___	___
Railroads	___	___	Music	___	___
Art	___	___	Airplanes	___	___

FAVORITE SPORTS

	THEN play-watch		NOW play-watch			THEN play-watch		NOW play-watch	
Football	___	___	___	___	Weight Lifting	___	___	___	___
Tennis	___	___	___	___	Baseball	___	___	___	___
Basketball	___	___	___	___	Soccer	___	___	___	___
Hockey	___	___	___	___	Track	___	___	___	___
Ping Pong	___	___	___	___	Handball	___	___	___	___
Pool	___	___	___	___	Bicycle Riding	___	___	___	___

I LIKED/LIKE TO WORK BEST (pick 5 most important)

	THEN	NOW		THEN	NOW
On small things	____	____	Building things	____	____
On large things	____	____	Out-of-doors	____	____
On paper	____	____	In-doors	____	____
On machines	____	____	Standing up	____	____
On repair work	____	____	Sitting down	____	____
On electrical things	____	____	With tools	____	____
In the country	____	____	On hard work	____	____
In the city	____	____	In a factory	____	____
In an office	____	____	With my hands	____	____

I LIKED/LIKE TO (pick 5 most important)

Keep machines and tools oiled	____	____	Keep clean	____	____
Make tool racks	____	____	Work in a clean place	____	____
Work with my own tools	____	____	Do arithmetic	____	____
Write about things	____	____	Dress nicely	____	____
Wear work clothes	____	____	Take care of tools	____	____

WHEN I WORK I LIKED/LIKE TO (pick 5 most important)

Keep clean	____	____	Be neat	____	____
Make money	____	____	Have a friend	____	____
Enjoy working	____	____	Complete work	____	____
Be on time	____	____	Follow Directions	____	____
Do a good job	____	____	Work every day	____	____
Get along with others	____	____	Have new ideas	____	____
Have long vacations	____	____	Have short hours	____	____

I LIKED/LIKE TO (pick 5 most important)

Know why things work	____	____	Put things together	____	____
Make things work	____	____	Do electrical work	____	____
Make plans for models	____	____	Collect things	____	____
Fix engines and motors	____	____	Experiment	____	____
Work on different kinds of things	____	____	Keep records	____	____
Be original	____	____	Do desk work	____	____
Report on work I did	____	____			

I LIKED/LIKE TO (pick 5 most important)

Meet important people	____	____	Help other people	____	____
Be well known	____	____	Be helped in my work	____	____
Be important	____	____	Make decisions	____	____
Be encouraged	____	____	Follow directions	____	____
Be the leader	____	____	Work with others	____	____
Work alone	____	____	Do as I please	____	____
Make my own plans	____	____	Figure things out	____	____
Work with things	____	____	Be my own boss	____	____
Work with people	____	____	Make friends	____	____
Please other people	____	____	Be in charge	____	____

Company or
Firm _____ Employer _____ No. of
Address _____ Supervisor _____ Workers ____

NEW YORK STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION RESEARCH

CHARACTERISTICS NECESSARY FOR SUCCESS IN MACHINE TRADES

CHARACTERISTICS NECESSARY FOR SUCCESS IN ELECTRICAL TRADES

What characteristics do you want your workers to have?

Personal Characteristics — In order of importance.

_____
_____
_____
_____
_____
_____

Social Characteristics — In order of importance.

_____
_____
_____
_____
_____

Work Characteristics — In order of importance.

_____
_____
_____
_____
_____

Attitude Characteristics — In order of importance.

_____
_____
_____
_____
_____

Interests that seem important to success.

_____
_____
_____

Temperament Characteristics that seem important.

_____
_____
_____

Answers on this page may but need not correspond to answers on previous page.

Characteristics of the most efficient and effective (the most successful) worker I have (possibly but not necessarily the best mechanic).

Personal

Social

Work

Attitudes

Interests

Temperament

Other

INDUSTRIAL – PRACTICAL ARTS RATING SCALE

Grades 7 - 12

Name _____ Address _____ Date of Birth _____ Age _____

Grade in School _____

Directions to the rater: This form is designed to determine characteristics which may have implications for the successful placement of a student in courses during future school years. When considering each of the items on this form please think of the student being rated as performing the duties of an occupation in which these duties are required.

Under each item the student will fall into one of five descriptions. Check the description which best describes the performance or attitude of the student.

Items	Descriptions	Check spaces

PERSONAL CHARACTERISTICS

Self motivated:

- Is obviously interested in working with tools and materials Shows interest through enthusiasm and initiative in new projects and ideas. _____
- Is interested in certain aspects of work. Attempts new projects and approaches. _____
- Is interested in completion of assigned work. _____
- Follows directions necessary to complete assigned work. Needs some supervision and direction. _____
- Needs constant supervision and direction. _____

Concern for others:

- Is obviously interested in general welfare and safety of fellow students and shows interest through actions. _____
- Is interested in certain aspects of welfare and safety for self and other students. _____
- Is interested mainly when own welfare will be affected. _____
- Claims to be interested in welfare and safety but does not contribute in any way. _____
- Shows little or no concern about welfare and safety of self or others. _____

Influence on others:

- Is a positive dominating force among fellow students. _____
- His/her opinions have a strong effect on other students. _____
- His/her opinions often reinforce the thinking of others. _____
- Occasionally his/her opinion sways others. _____
- Has no effect on thinking of others. _____

Responsibility:
- Accepts each problem as a challenge and uses all possible means to solve problems or perform duties. Can be depended upon to perform well on any assignment. _____
- Satisfactorily completes assigned work without direct supervision or direction. _____
- Satisfactorily completes assigned work. Occasionally needs supervision or direction. _____
- Completes assigned work if limited in size and scope. Often needs instruction, supervision and direction. _____
- Needs constant instruction, supervision and direction. _____

Self-control: (Poise, emotional stability)
- Is always calm, composed, and patient. _____
- Is generally composed but is disturbed by irregularities. _____
- Is generally composed but shows annoyance at irregularities. _____
- Is easily upset and becomes inefficient. _____
- Is easily upset and is highly emotional. _____

Critical self-analysis:
- Sets high standards and strives for self-improvement. _____
- Tries to achieve existing standards. _____
- Is aware of own mistakes and tries to correct them. _____
- Seldom recognizes own mistakes or weaknesses. _____
- Fails to recognize own mistakes or weaknesses. _____

Attitude toward criticism:
- Accepts criticism pleasantly and with gratitude for instruction. _____
- Accepts criticism pleasantly. _____
- Accepts criticism without comment or obvious reaction. _____
- Accepts criticism with some resentment. _____
- Shows some annoyance when criticised. _____

Adjustability:
- Appears to be at ease with and is accepted by fellow students. _____
- Does not actively mingle with fellow students but seems to be accepted by them. _____
- Tries to mingle and associate with others but is not enthusiastically accepted. _____
- Makes no attempt to associate with others. _____
- Has personal characteristics which militate against being accepted by others. _____

Neatness: (Personal)
- Is regularly neat and clean in appearance. Dresses appropriately for work to be done. Performs all duties remaining neat in appearance throughout the period. _____
- Is generally neat and clean in appearance. Pays little attention to neatness during day. _____
- Is occasionally neat in appearance. Clothing and appearance lack freshness. _____
- Is acceptable in appearance but is seldom neat and fresh looking. _____
- Pays little or no attention to personal neatness or cleanliness. _____

Courtesy:

- Is always considerate, courteous, and polite in dealings with others. _____
- Is generally polite in dealing with others. Occasionally appears to be too busy to be courteous or polite. _____
- Is courteous and polite when with people of interest to him/her. _____
- Is seldom courteous. _____
- Is crude and pays little or no attention to desirable social behavior. _____

Physical: (Health)

- Appears to be in good health and performs work accordingly. _____
- Appears to be in good health but tires quickly. _____
- Occasional minor illnesses cause some absence. _____
- Poor general health causes frequent absence. _____
- Poor general health militates against successful performance of work. _____

Physical: (Structural)

- No physical defect which militates against efficiency. _____
- Slight physical defect which sometimes affects efficiency. _____
- Physical defect limits extent of work or assignment. _____
- Physical defect makes completion of work difficult. _____
- Physical defect severely limits efficiency. _____

WORK HABITS AND ABILITIES (GENERAL)

Punctuality:

- Regularly arrives on time and quickly prepares for work. Returns promptly from assignments outside of room. _____
- Arrives on time daily. Takes time preparing for work and returning after being out of room. _____
- Is generally punctual however does not seem to be concerned about time. _____
- Is often late. Takes time in preparing for work and returning after being out of room. _____
- Is seldom on time. Must be closely supervised. _____

Regularity of attendance:

- Has almost perfect record of attendance. Can be depended upon to be present. _____
- Has good record of attendance. Cannot be depended upon, however, to be in school at any particular time. _____
- Is usually in school. Cannot be depended upon. _____
- Is frequently absent from school. Seems to lack interest. _____
- Excessively absent from school. _____

Following directions:

- Can be depended upon to follow directions without exception. _____
- Follows directions most of the time. _____
- Follows directions when they seem to be necessary to him/her. _____
- Follows directions occasionally depending on own enthusiasm. _____
- Must be closely supervised and directed. _____

Interpretation of oral directions:

Immediately interprets oral instruction in terms of work to be performed. Has clear understanding of what is wanted. _____

Occasionally needs clarification of oral instruction in terms of procedures to be followed. _____

Needs oral instruction repeated and clarified regularly. _____

Cannot be depended on to fully carry out oral instructions in terms of work to be performed without frequent supervision and direction. _____

Does not understand oral instruction in terms of work to be performed. Needs graphic illustrations or demonstrations. _____

Interpretation of written directions: (Printed, typed or diagrammed)

Immediately interprets written instructions in terms of procedures to be performed. Has clear understanding of what is wanted. _____

Occasionally needs clarification of words, sentences, or symbols before being able to carry on necessary work. _____

Often needs oral explanation of written directions. _____

Almost always needs oral explanation or demonstration to clarify written directions. _____

Does not understand written directions after attempts at clarification. Written or printed directions tend to confuse him/her. _____

Seriousness of purpose:

Sets clear definite goals and works constantly toward the attainment of these goals. _____

Attacks and works dilligently on immediate problems. Does not often plan ahead. _____

Makes broad plans but seems to concentrate on small problems of interest rather than to the accomplishment of work. _____

Makes plans but does not always follow plans or complete work to be done. _____

Lacks drive, decisiveness, and perseverance. _____

Creativity:

Shows imagination and originality in solving problems and in carrying out assignments. _____

Shows tendency toward imagination and originality in solving problems. _____

Tries to contribute new ideas but lack sufficient knowledge, imagination and originality to make worthwhile contributions. _____

Makes no original contributions but appreciates contributions of others.

Resents introduction of new approaches and ideas. _____

OCCUPATIONAL CHARACTERISTICS

Neatness: (While Working)

Arranges tools, equipment, and supplies in neat workmanship way. Keeps tools arranged in neat order during working day. Working area is kept clean and in order. _____

Has systematic way of approaching jobs to be done. Is generally neat and clean in caring for working area. _____

Uses tools and equipment necessary to perform work assigned in order of need. Puts tools away and cleans work area when job is completed. _____

Uses tools and equipment to perform work assigned. Gathers tools when job is completed but does little to arrange them or clean work area. _____
Uses little or no system in arranging, keeping, or handling tools or in care of tools or work area. _____

Cleanliness:

Works in clean workmanlike manner. Keeps work area clean while working. Cleans tools, equipment, and working area immediately after use. Maintains personal cleanliness. _____
Attempts to keep equipment, area, and self clean during performance of work. Always cleans tools and area after completing work. _____
Is careless about cleanliness of tools or area while working. Completes work but cannot be depended on to clean area after completion. _____
Rarely cleans tools, equipment, or area during performance of work. Work area often left dirty after completion of work. _____
Is generally careless about cleanliness of tools and property. Makes little or no attempt to keep tools or area clean. _____

Safety:

Has high regard for safety. Uses all safety precautions in the use of tools and equipment. Has not had or caused any injury to occur. Makes safety improvements or suggestions. _____
Is generally safety conscious and careful while working alone or with others. Follows safety rules diligently. _____
Is generally safety conscious and careful while working alone or with others. Will sometimes sacrifice safety for speed or convenience. _____
Regards most safety regulations as unnecessary but does conform. Often sacrifices safety for speed or convenience. _____
Regularly disregards safety regulations and safety of others. _____

Use of time:

Attacks problems logically and systematically. Develops procedures or aids (short cuts) to save time without loss of accuracy. Has thorough knowledge of tool useage making rapid work possible. Does not waste time. _____
Attacks problems logically and sequentially. Sets up procedures to save time doing job but works at constant slow rate of speed. _____
Works on assigned jobs at own rate of speed. Leaves job occasionally for various reasons. Is efficient when working. _____
Works on assigned job in leisurely fashion. Takes time in arranging materials and in getting started. Efficiency while working is fair. _____
Does not seem to be concerned about time. Takes time from work for various reasons at frequent intervals. _____

Care of tools, equipment:

Handles equipment with care and respect. Carefully and correctly uses, cleans, maintains, protects, and stores equipment. Care is daily. _____
Handles equipment with care and respect. Uses tools carefully and correctly and stores them systematically. _____
Performs necessary operations and functions with tools and equipment. Hastily cleans and puts equipment in order at the end of the day. _____
Uses tools and equipment to do job. Gives little attention to condition or care of equipment. _____

Is generally careless about the use and care of tools and equipment.
No attention is given to the correct use or care of such equipment. _____

Work rate:
Works carefully and rapidly. Regulates speed to maintain steady and productive pace without causing errors to result. _____
Works carefully and rapidly. Maintains steady pace in spite of occasional errors. _____
Works carefully and at moderate rate of speed. Maintains steady pace in spite of occasional errors. _____
Works at moderate rate of speed. Is slowed down because of occasional problems. _____
Speed is relatively slow. Occasional errors exist. _____

Cordination: (Muscular, intellectual, procedural)
Highly efficient in making operations, processes, and procedures coincide. Can work rapidly and smoothly without causing confusion of procedures or damage to equipment, tools, materials, or products. _____
Can work on difficult operations or processes without causing confusion or damage. Speed is somewhat affected because of time necessary to consider aspects or problem or to perform processes. _____
Efficiency is affected by work which requires complicated or involved thinking or handwork. _____
Only simple operations and tasks can be assigned without supervision. _____
Lacks coordination necessary to perform the job without supervision. _____

Interpretation of sketches, drawings, schematics:
Readily reads and correctly interprets drawings. _____
Reads and interprets simple drawings and sketches. _____
Has some difficulty but puts forth effort to read and learn. _____
Cannot read drawings without some assistance. _____
Shows no interest or aptitude in reading drawings. _____

Accuracy in making out orders or bills of material:
Makes out detailed, clear, and accurate orders and/or bills. _____
Makes bill or order accurately but lacking in detail and clarity. _____
Makes occasional errors in details and accuracy. _____
Often makes errors in details and accuracy. _____
Cannot be given responsibility to prepare orders or bills. _____

Sequence of procedures:
Makes careful analysis of job and the order in which it can be done most efficiently. Has ability to break job to be done down into simplest elements and to develop logical sequence of procedures. _____
Makes careful analysis of job and the order of procedure to be followed. Occasionally neglects minor details causing problems to arise. _____
Makes analysis of job and order of procedure to be followed. Fails to anticipate difficulties. _____
Breaks jobs down into smaller jobs each having their own sequence. Fails to consider all aspects of work to be done. _____
Pays little or no attention to sequence. Must be supervised. _____

Judgement in the use of tools, machines, equipment:

- Considers purpose, capabilities, and limitations of tools when performing work. Always uses appropriate tools. _____
- Generally considers the selection of tools in terms of the work to be done however occasionally uses the most convenient tool. _____
- Selects tools on the basis of convenience rather than correctness. _____
- Has limited knowledge of the purposes or capabilities of tools. Uses judgment when directed and supervised. _____
- Has limited knowledge of the purposes or capabilities of tools. Shows little or no interest in learning. _____

Assembly of materials, parts, equipment, products:

- Is systematic in checking sizes and condition of parts before finally arranging or assembling. Prevents errors by giving attention to detail and final adjustments. _____
- Is systematic in checking before assembling. Is generally careful about condition and correctness of parts. _____
- Checks parts before beginning assembly. Is careful about condition of parts. Assembles work in satisfactory condition. _____
- Checks parts before beginning assembly. Assembles work with little attention to condition of parts or to condition of assembly. _____
- Is careless in the handling of parts and in assembling. _____

Accuracy of performance:

- Is highly accurate and precise in all work performed. Rarely deviates from expected standards. _____
- Is generally accurate. Most of work performed is within expected standards. _____
- Has tendency to be more accurate in performing one type of work than in performing others. _____
- Works within limits of acceptable accuracy but rarely demonstrates a high degree of accuracy. Occasionally guesses at measurements. _____
- Cannot be given responsibility to perform accurate work without close supervision. _____

Mathematics: (Computations)

- Is efficient and exacting in the use of mathematics necessary to the work being done. Use of mathematics in the performance of the job is readily accepted. _____
- Is generally efficient in the use of mathematics but does not readily apply it when needed. _____
- Is generally efficient in the use of mathematics but cannot see its applications to the work being performed. _____
- Tries to apply mathematics to the work being done but needs further training or practice to make useful application to the work. _____
- Lack of background and interest make the use of mathematics in connection with the work impractical. _____

Skill:

- Seems to have a natural ability to do a job well. Takes pride in work. _____
- Is generally skillful. Exhibits a reasonable amount of skill in all work performed. Work is almost always skillfully completed. _____
- Is selectively skillful. Most work is skillfully performed. Has preference for certain types of work. _____
- Work is generally satisfactory but is not skillfully performed. _____
- Is capable of satisfactory work but must be closely supervised. _____

Student _____ Grade ___

INDUSTRIAL-PRACTICAL ARTS RATING FORM

PROFILE SHEET

Directions: Please copy ratings which have been given on the rating scale onto this profile sheet. Duplicate copies should be made so that the profile can be used both as a record and as a basis for consultation.

Student _____ Industrial Arts Laboratory _____ Date of birth _____ Age _____

Instructor _____ Key: 1 = Outstanding 5 = Poor

	1	2	3	4	5
PERSONAL CHARACTERISTICS					
Self motivated					
Concern for others					
Influence on others					
Responsibility					
Self-control					
Critical self-analysis					
Attitude toward criticism					
Adjustability					
Neatness (Personal)					
Courtesy					
Physical (Health)					
Physical (Structural)					
WORK HABITS and ABILITIES (GENERAL)					
Punctuality					
Regularity of Attendance					
Following directions					
Interpretation of oral directions					
Interpretation of written directions or instructions (printed)					
Seriousness of purpose (Permanency)					
Creativity					
OCCUPATIONAL ABILITIES (MECHANICAL-AGRICULTURAL)					
Neatness (On the job)					
Cleanliness					
Safety					
Use of time					
Care of tools, machines, equipment					
Work rate					
Coordination (Muscular, intellectual, procedural)					
Interpretation of sketches, drawings, schematics					
Accuracy in making out orders or bills of materials					
Sequence of procedures					
Judgment in use of tools, machines, equipment					
Assembly of materials, parts, equipment, products					
Accuracy of performance					
Mathematics (computations)					
Skill					

Should this student be guided toward trade training? Yes _____ No _____

What occupational area or trade would you suggest for this student? _____

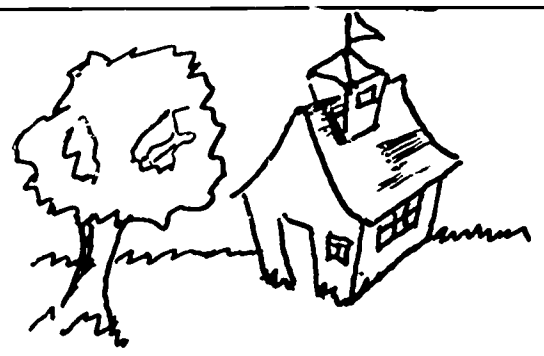
_____

EXPERIMENTAL FORM:

Name _____ Age _____ Class _____

THE UNIVERSITY OF THE STATE OF NEW YORK
New York University Project
Occupational Interest
Checklist

DIRECTIONS: PUT A CHECK (/) NEXT TO THE FIVE THINGS YOU LIKE BEST IN EACH BOX.



School

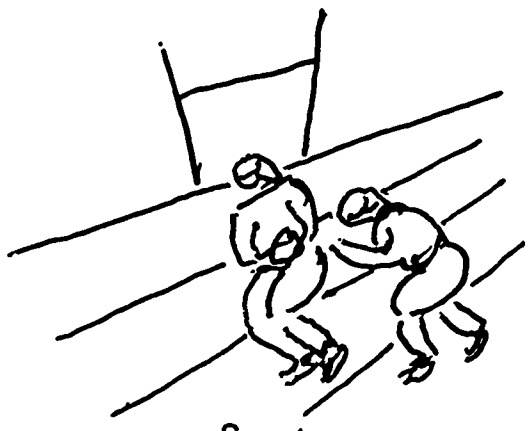
SUBJECTS I LIKE BEST

English	____	Industrial Arts	____
History	____	Home Economics	____
Mathematics	____	Music	____
Science	____	Health Education	____
Language	____	Other	____

Hobbies

HOBBIES I LIKE BEST

Art Work	____	Radio Repair	____
Ceramics	____	Fixing Things	____
Metal Work	____	Collecting	____
Wood Work	____	Automobile Work	____
Stamp Collecting	____	Machine Work	____
Jig Saw Puzzle	____	Hiking	____
Travel	____	Gardening	____
Making Things	____	Hunting	____
Fishing	____		____



Sports

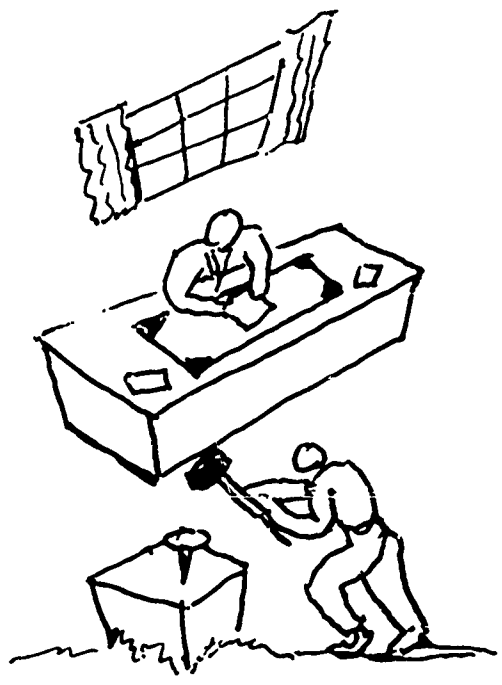
SPORTS I LIKE BEST

	to play	to watch		to play	to watch
Football	____	____	Weight Lifting	____	____
Tennis	____	____	Baseball	____	____
Basketball	____	____	Soccer	____	____
Hockey	____	____	Track	____	____
Ping Pong	____	____	Handball	____	____
Pool	____	____		____	____

Games

GAMES I LIKE BEST

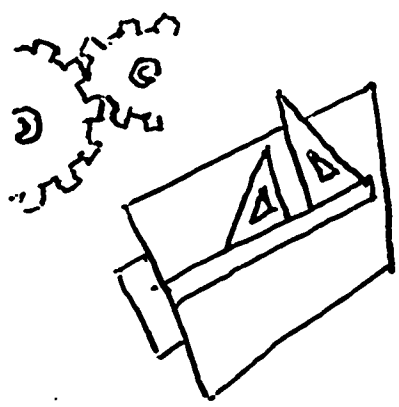
Cards	____	Ping Pong	____
Checkers	____	Jig Saw Puzzles	____
Chess	____	Pool	____



Work

I LIKE TO WORK BEST

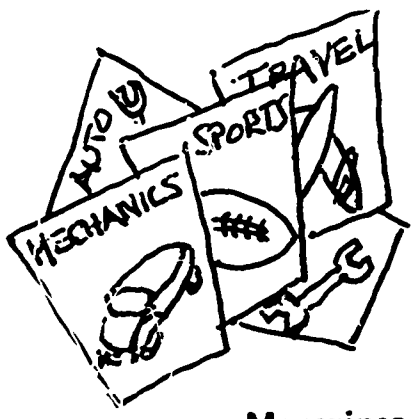
On small things	____	Building things	____
On large things	____	Out-of-doors	____
On paper	____	In-doors	____
On machines	____	Standing up	____
On repair work	____	Sitting down	____
On electrical things	____	With tools	____
In the country	____	With my hands	____
In the city	____	Do hard work	____
In an office	____	In a factory	____



Interests

I LIKE TO

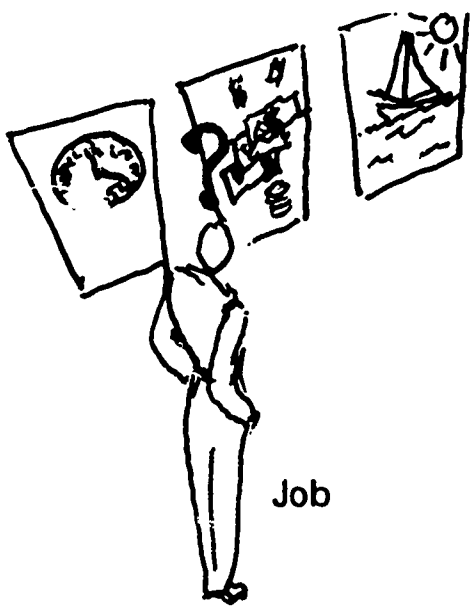
Know why things work	____	Put things together	____
Make things work	____	Do electrical work	____
Make plans for models	____	Collect things	____
Fix engines and motors	____	Experiment	____
		Keep records	____
Work on different kinds of things	____	Do desk work	____
		Be original	____
Report on work I did	____		____



Magazines

I LIKE MAGAZINES ABOUT

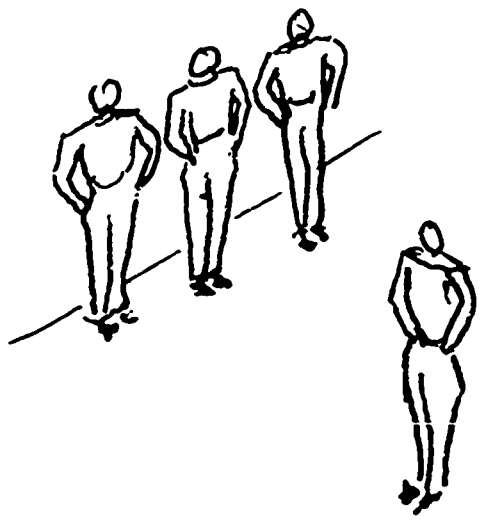
Sports	____	Automobiles	____
Mechanics	____	Gardening	____
Travel	____	Machinery	____
Movies	____	Westerns	____
Science	____	Music	____
Railroads	____	Airplanes	____
Art	____	Scouting	____



Job

WHEN I GET A JOB IT WILL BE IMPORTANT TO

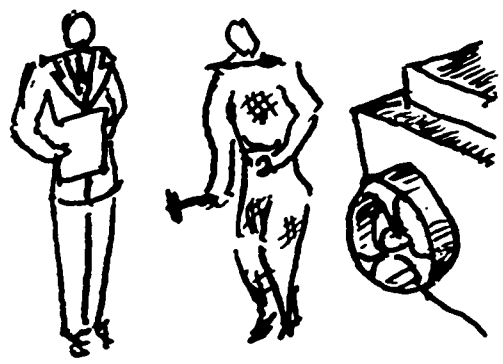
Keep clean	____	Be neat	____
Make money	____	Have a friend	____
Enjoy working	____	Complete work	____
Be on time	____	Follow directions	____
Do a good job	____	Work every day	____
Get along with others	____	Have new ideas	____
Have long vacations	____	Have short hours	____



People

I LIKE TO

Meet inportant people	____	Help other people	____
Be well known	____	Be helped in my work	____
Be important	____	Make decisions	____
Be encouraged	____	Follow directions	____
Be the leader	____	Work with others	____
Work alone	____	Do as I please	____
Make my own plans	____	Figure things out	____
Work with things	____	Be my own boss	____
Work with people	____	Make friends	____
Please other people	____	Be in charge	____



Work Conditions

I LIKE TO

Keep machines and tools oiled	____	Dress nicely	____
Make tool racks	____	Keep clean	____
Take care of tools	____	Do arithmetic	____
Work with my own tools	____	Work in a clean place	____
Write about things	____	Wear work clothes	____