A STUDY OF BOYS OF THE
ROBERT L. SABIN HIGH SCHOOL
by
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CHAPTER I
INTRODUCTION

Since the time of Herbart and the resultant psychology of education, a great deal has been written on the subject of individual differences. Along with the growth of psychology of individual differences there has developed a movement to provide special education to meet individual needs. One of the results of this movement has been the establishment of special schools to provide education for students who, due to their individual needs, do not fit into a traditional school. Probably the first of such schools was founded at Waukegan, Illinois, by Superintendent Hall, in 1905. Previously, classes for backward children had been formed in other city systems, notably Cleveland, Chicago, and New York, but the school at Waukegan seems to have been the first complete school to be organized to take care of all types of misfits.

The School

Since these early starts, many such schools have

been founded. The city school system of Portland has used an ungraded room system for a long time in an attempt to care for certain types of misfits. In 1926 a school within a school system was tried in connection with the Benson Polytechnic School. It was called the Benson Pre-vocational School and was intended to provide pre-vocational training for certain types of problem cases and to get them ready for high school work at Benson or at some other high school. This school proved to be very satisfactory; however, the quarters were too limited to take care of all the problems. It remained in operation until 1936.

About 1931 another school within a school was organized under the name of Buckman High School. This school was provided as a disciplinary measure, or whip, for students whose chronic failures were due to lack of effort and application. This school continued to operate under the disciplinary philosophy until 1936.

In the spring of 1936, the disciplinary school and the pre-vocational school were merged under the name of the Edison Six-year High School which operated for one term as a co-educational institution for problem cases.

Then in the fall of 1936, the girls were moved to other quarters and one school became the Edison Six-year High School for boys, and the other, the Edison Six-year High School for girls. Two years later the schools were
re-named. The Edison Six-year High School for girls became the Jane Adams High School, and the Edison Six-year High School for boys became the Thomas A. Edison High School. The school for boys, through a gradual changing of philosophy and curricula, soon outgrew its building facilities and in the fall term of the school year 1940-1941, the school was removed to new quarters. In an effort to remove a certain stigma which became attached to the school under the early philosophy and to give recognition to the man who had donated the land, the name was again changed. Thus the name, Robert L. Sabin High School, was given to the school.

The Organization of the School

The Robert L. Sabin High School, as it now exists, was organized on a six-year plan which embraces the seventh and eighth grades as well as the four years of high school. This organization was planned to serve several purposes. One purpose was to facilitate the transition between the elementary and the high school. In other words, it was believed, since there are no junior high schools in Portland, that this organization would help to "bridge the gap". Another purpose was to provide a closer homogeneity of age, maturity, and achievement than was found in the same grade levels in other schools. A third
purpose was to provide an opportunity for further education for those boys who, due to inability to "keep up", would be forced to drop out of the traditional high school program. A fourth purpose was to provide a classroom situation in which classes would be small enough so that individualized instruction could be maintained effectively.

The Curriculum

The curriculum of the Robert L. Sabin High School might be said to be a modified core-curriculum, with the core being composed of the work required by the State Department of Education for graduation. In the junior division or seventh and eighth grades the curriculum is divided between the required English, mathematics, social science, and physical education, and various elective activities in the nature of shop work. In the senior or High School division the work is divided between the required subjects of English, mathematics, history, general science, and physical education, and elective courses in commercial subjects, shop work, history, science, English, orchestra, glee club, cooking, consumer education, occupations, and salesmanship. Roughly it is planned that a student will spend one-half of his time at academic work and one-half at work which is more or less
activity in nature.

The senior division offers two curricula at the Robert L. Sabin High School. One is the traditional college preparatory or four-year course while the other is a special three-year or industrial course. This industrial course is composed of fourteen credits which are earned in special courses in the fields of mathematics, English, general science, physical education, and history together with ten credits of electives.

The courses of study for the most part are designed by the teachers in the various departments of the school in collaboration with the principals, supervisors, and superintendents, excepting where there are State Department requirements.

Promotion and Graduation

Promotion in the junior division is based upon recommendation of the faculty and the principal with due consideration for the results of the achievement and intelligence tests. In the senior division, promotion is based upon the satisfactory completion of the course of study.

Graduation in the junior division is handled in the same manner as junior promotion except that there are two types of diplomas issued. One diploma entitles the holder
to admission to the high school in his district while the other diploma entitles the holder to admission to the senior division at the Robert L. Sabin High School only. In the senior division, graduation is based upon completion of either the college preparatory course of thirty-two credits, which is known as the four year course, or completion of twenty-four credits which is known as the three-year or industrial course which has been explained earlier.

Admission and Transfer

A uniform system of admission and transfer for high school students is used in the Portland school system. However, in connection with the Robert L. Sabin High School set-up, certain complications arise due to special students, diplomas, and curricula. Originally all pupils were assigned to the school or came of their own volition. However, this system produced a certain stigma and feeling of shame among many students so that finally the compulsory attendance was eliminated. Admission now is entirely volitional, based upon the student's wish, and counseling in the other schools.

Transfer from the Robert L. Sabin High School to another school is handled on a slightly different plan. If a pupil wishes to transfer, his written request to do
so is passed upon by a faculty committee and the Principal. The final decision is influenced by the student's attendance, attitude, scholastic success and mental ability.

The Students

The personnel of the student body at the Robert L. Sabin High School is highly varied in some respects, being drawn from all economic and social classes. Almost every section of the city is represented. Many are perfectly normal boys who like the curricula, the faculty, and the organization at the Robert L. Sabin High School. The rest are handicapped, in the broadest sense, in some form or other. With some, the handicap is low mentality, with others, the problem is emotional instability, with still others, the trouble is physical deficiency, and with a small group, the lack is that of ethical behavior. In short, the students are those who do not "fit in", for any reason whatsoever in the regular school program as set up in the other schools.

The Faculty

Much care has been taken to select an adequate faculty for the Robert L. Sabin High School. Three things in particular are expressly sought after; youthfulness of educational outlook, broad experience, and training. In
all of the six shops, the instructors have had years of experience outside of school, in the work which they are teaching. This is also true of the teachers in other departments, and, with three exceptions, each of the faculty has had many years of successful teaching experience. In the matter of professional training, there are eight of the faculty who either have master's degrees or are expecting to receive them in the near future. With regard to youthfulness, the faculty can claim desirable attribute in both educational outlook and spirit.

Objectives

In the fall term of the school year 1938-1939, the faculty of the then Edison Six-year High School was given a questionnaire on objectives for the school. A committee was then appointed to compile the replies and make a report. The following on objectives and comments is the report of that Committee and perhaps explains best what this school is attempting to accomplish.

The faculty of the Edison Six-year High School was supplied with a questionnaire which would serve as a guide for working out the objectives for our school. Instructors have cooperated and each individual has considered the school in the light of his personal objectives, his educational ideals, and the results of his experience in our particular situation.
I. General aim:

A. To offer opportunity, adjustment, and socialization to those unable to cope with the traditional school situation.

We wish to help the mentally or otherwise "stymied;" and the non-academic minded who need an opportunity for developing and enhancing the creative ability necessary to social and personal adjustment.

We want to give the student liberal contacts with both industrial and academic curricula that he may find something that he can do, and thus lay the foundation for his work, whether it be professional or industrial.

II. Specific aims:

A. To recognize the immediate needs of the boy.

This school must be frank enough, honest enough, and brave enough to break with tradition. We must take the boy where we find him without regret for his past, without over-solicitude for his future, and provide something for him right now which will enable him to feel the thrill of success.

B. To build character and work-study habits which will carry over into adult environment.

C. To develop an open and inquiring mind. This type of boy must be liberated from class prejudices, concepts brought about by failure, the social lag produced by unfavorable circumstances and environment, and the bitter reactions for which he is not responsible.

D. To develop a knowledge of good health habits, and the desire for pleasing personal appearance, together with a respect for the social amenities.
E. To develop a consciousness of the value of responsibility, reliability and cooperation. To teach citizenship by personal experiences in a democratically organized school.

F. To develop a respect for property.

G. To develop recognition of worthy leadership. So often the mediocre mind is a ready follower of the flashy and sensational leader.

H. To develop intelligent followers with a respect for constituted authority.

I. To inculcate the fundamental skills of speaking, reading, writing, and calculating. We need an extremely flexible program so that remedial work may be given at the exact time it is needed.

J. To make provision for exploratory opportunities paralleling the student's growing interests.

K. To bring about satisfaction through success in school activities, in satisfying use of leisure time, and in a normal outlet for emotions.

III. The school in general:

A. Grade levels: 7 through 12

Boys should be admitted as soon as adolescent maladjustments appear, so the present seventh grade level is probably a good starting point. They should be allowed to continue as long as they feel that we have something to offer them, or until graduation. There should be no break between Junior and Senior Divisions, except to provide for greater flexibility in the Junior Division.

The terms "7th" and "8th" grade should be dropped and some other designation, such as 1st, 2nd, 3rd, 4th, 5th, and 6th term, should be used.
B. Type of program.

The program should include academic and pre-vocational exploratory courses in conjunction with occupational training and information.

C. Weight given to each division.

This should depend upon the type of work in which the boy is most interested. Shops should be emphasized for those who are mechanically inclined; academic work should be stressed for those who are not interested in shop or have no mechanical aptitude. In cases of uncertainty or possible lack of ability, a generous sampling may be the solution.

D. Value of credits and time of graduation and transfer.

1. Full value should be placed on credits earned for either:
   (1) graduation from the Edison Three-year Course,
   (2) graduation from the Edison Four-year Course, or
   (3) transfer to and graduation from some other high school.

   If the course at Edison does not meet the requirements of the school to which the boy transfers, he should be required to complete the course at that school, but at the same time his Edison courses should all be accepted as electives.

2. The program of the so-called academic schools should not be too rigidly followed. The fundamental subjects should be offered, but not from the same textbooks nor handled in the same manner. The curriculum should be richer than in any other school in appreciation courses, in art, music, dramatics, and in leisure time activities.
3. Full value should be given credits transferred from one school to another. If a course given in any school is worth giving at all, it is deserving of acceptance by any other school.

4. Graduation should take place when a student has put forth serious effort, and has performed to the best of his ability the tasks assigned him in a given course (in Edison either the Three-year or the Four-year Course).

5. The question of transfer to another school should end as soon as possible. Edison must build its own student body and shifting should not be more noticeable than that found in other schools. When we have a suitable building, properly equipped, and a definite program of distinction, those who matriculate in our school will remain, as they will definitely be the type of boy who needs the training that we offer.

However, if and when transfer is advisable, it should take place at any time that the principal and teachers decide it is for the best interest of the boy. This might be a few days or weeks after the boy enrolled at Edison, at the end of a six-week's period, at the end of one or two terms, or perhaps after two or three years. There should be no fixed rule.

IV. The Student body:

A. We should admit to the school at the 7th or 8th grade level boys who are having difficulty in their schools, who are unhappy, and who, as a result, may become discipline problems. This includes boys who:
1. are oversize
2. are overage
3. are misfits emotionally
4. are timid and self-conscious
5. cannot carry full loads
   because of health or home
   conditions
6. have been out of school for
   two or more years

These boys are lost in larger groups
and are in need of individual help and
consideration.

B. We should deny admission to.

1. Those who intelligence falls
   below a certain minimum standard.
   This standard should be set by
   the research department. We
   suggest a minimum of I.Q. 70.

2. Boys who come voluntarily from
   other high schools with the idea
   of making many credits easily
   and quickly and then returning
   to their original schools to
   graduate.

3. Those who after an honest effort,
   Edison has failed to help and
   who are a detriment to the school.
   A committee of teachers should
   have authority to exclude such
   boys.

V. Physical needs:

The plant should be modernized. The
boys feel that they are considered un-
important and that "the school" thinks any
old building is good enough for them. The
resentment caused by this feeling is
 transferred to the teaching staff, thus
making it doubly hard for instructors to
win their confidence.

Pending a "new front" the following are
urgently needed:

1. Lockers for all
2. Safe and adequate showers
3. Adequate lighting
4. Additional space and equipment for
   shops
5. Store room for science department  
6. Equipment for gymnasium  
7. Football field and equipment  
8. Recreation room  
9. Adequate equipment for music department  
10. More books for library  
11. Lunch rooms  
12. Lavatories for faculty  

VI. Miscellaneous:

A. School to be re-named Edison High School.  

B. The girls' division, if it is to be kept separate in the future, should be given a name more appropriate. This recommendation is made with the hope of eliminating confusion and adding distinction to each school.  

C. Class enrollment should be limited to an absolute maximum of 20 students. We defeat our own ends if the classes are not kept small.  

D. Each teacher at Edison must of necessity be versed in counseling. This should be realized when teachers are selected for this school and those who are chosen should be particularly suited for counseling and guiding our particular type of student.  

E. In view of the above statement, the school program should be so arranged that each teacher has one period daily in which individual conferences can be held.  

Limitations of the Study  

This study cannot hope to cover all aspects of the nature of the boys at the Robert L. Sabin High School. As  

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Faculty Committee, Objectives for Edison Six-year High School, unpublished Committee Report, Edison Six-year High School, 1938.
a result, within certain limitations, this work is confined to a study of their intelligence, English usage, interests, personality, mechanical ability, visual acuity, and the inter-relation of these aspects. The results shown can claim only such validity as that of the tests employed and the sampling obtained. Also the reliability of the findings of this study may be somewhat affected by the presence of, or lack of, rapport between the testers and the testees since all of the tests, with one exception, were administered by strangers and each boy completed the battery of tests in a single day.
CHAPTER II
PROCEDURES OF THE STUDY

General Procedure

Under the administration of the Department of Vocational Education in the Portland school system, there has been established a special testing bureau known as the Psychometric Laboratory. This testing bureau under the direction of Robert L. Goetz, operates as a vocational testing clinic for the schools as well as for business and industrial firms.

Due to the fact that the Robert L. Sabin High School did not have facilities for the testing program planned in connection with this study, the help of Mr. Goetz and his staff was sought and kindly granted. Plans were then formulated whereby the boys from Robert L. Sabin High School would go to the Psychometric Laboratory to take the tests. These tests were administered and scored by Mr. Goetz and his staff and the results were made available to the writer for study and interpretation.

The Sample

At the conference with Mr. Goetz, the question of the number who should take the tests was raised. Mr. Goetz expressed a willingness to test the entire student body of five hundred boys. However, after further
discussion it was decided that the testing program should be made available to the Senior Division only and be open to all of that division who wished to take the tests, but no compulsion should be used. This plan was followed and approximately one hundred and twenty-five boys made use of the opportunity. However, a few did not finish the tests so complete returns were not available for all of the sample.

The Tests Used

As has been stated earlier, this study cannot hope to cover all aspects of the nature of the boys at Robert L. Sabin High School. In order to get a fairly comprehensive overview of the capacities of these boys, it was decided that the following fields should be examined: intelligence, English usage and vocabulary, personality, mechanical ability, occupational interest, and visual acuity.

Possibly the study of visual acuity belongs with a study of physical aspects, but the writer feels that since vision plays such a large part in the development of the other aspects studied, it has a place in this work.

The tests used to determine intelligence were the Pressey Senior Classification, and the Otis Self-Administering Tests of Mental Ability. The Otis tests
were administered at the Robert L. Sabin High School as a part of the regular testing program which the school maintains. The decision concerning which form of the Otis test to be used was left to the discretion of the tester. The Pressey Senior Classification Test was administered at the Psychometric Laboratory. The value of this test is expressed by the following quotation:

Although there are more reliable and searching measures of academic aptitude...more is known about the vocational significance of its scores than is the case with most tests of verbal intelligence...1

Examination into the students' English usage ability was made by means of O'Connor's English Vocabulary Test, Work Sample 95, Form EA, and the De Busk edition of the language usage test used in the Department of Research and Measurements of the Portland public school system. The O'Connor Vocabulary Test is designed to test reading vocabulary only. Since ability to comprehend what is read is so important, this test should be highly significant from the standpoint of guidance. The language usage test is designed to test grammatical form. The two used together give a pretty good index as to what an individual's reading vocabulary is, and how well he is able to use it.

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1 Counseling Bureau, Vocational Education Department, Administering and Scoring of Tests, Portland Public Schools, p. 6, 1940.
To study the occupational interests of the students, use was made of the Van Allyn Basic Interest Questionnaire, Form B. This questionnaire is very comprehensive and adds one feature not usually found in interest questionnaires, namely, the testee's estimation of how good he is in each of the items inquired into. The test is designed to isolate basic interest areas and a key is provided by which a counselor can interpret these areas into vocational possibilities. In the hands of a guidance expert this test could be very useful.

Inquiry into the personality of the boys at the Robert L. Sabin High School was made by means of the Bernreuter Personality Inventory. Assuming that this test is reasonably valid, it provides an excellent insight into the personality of an individual on six counts: neurotic tendency, self-sufficiency, introversion-extroversion, dominance-submission, self-confidence, and sociability. For either individual or group studies, this test should be highly satisfactory.

In the study of the mechanical ability of these boys, a battery of tests was used to sample as many aspects of mechanical ability as possible. Dexterity of movement was tested by three means: The Minnesota Manual Dexterity Test, the O'Connor Finger Dexterity Test, and the O'Connor Tweezer Dexterity Test. These are actual tests
of rapidity of physical movement. Recognition of spatial relationship was tested by the use of the Minnesota Spatial Relations Test, and the O'Connor Wiggly Block Test tested the ability to visualize structure in three dimensions. These tests entail rapid recognition of shapes and their relation to each other. For testing ability to assemble, the Minnesota Mechanical Assembly Test was employed. In reality four things are tested in this test: rapidity of movement, dexterity, recognition of shape and form, and familiarity with common mechanical devices. Under existing analyses of what goes to make up mechanical ability, this battery seems to cover the ground very well.

Since good vision plays such an important part in life, the writer felt that this study would not be complete without an examination into the eyesight of the cases under study. As a result the Bett's Visual Acuity and Color Blindness Test was administered. This test is a battery of eight tests, namely: binocular vision, distance fusion, visual efficiency, vertical imbalance, coordination level, lateral imbalance, reading distance fusion, and sharpness of vision. No attempt was made in this study to explain why the eye defects exist. The purpose is merely to point out that some do exist, and to call attention to possible results.
Testing Methods and Procedures

The general method of procedure in this testing program was to have the boys report to the Psychometric Laboratory instead of to school on a given day. The Laboratory is well equipped to handle twenty cases per day and, since this roughly corresponds with the size of classes at the school, it was decided that the boys should report by registration rooms.

Upon arrival at the Laboratory, the boys were requested to fill out a registration form after which the testing proper was begun. As a general rule the following order of testing was employed; first, the classification and English usage tests were administered; second, the mechanical ability and visual acuity tests were given; and third, the personality and interest inventories were taken. This general order was used to afford a break or rest between the sections of the paper and pencil tests.

An attempt to lessen the effects of fatigue was also made in administering the mechanical ability battery. Tests involving a similar type of movement were never given successively nor were tests which utilized the recognition of spatial relations allowed to follow each other.

In general the tests were all completed in a single day. However, a few tests had to be administered at a
later date due to the fact that some of the boys had jobs after school and were unable to finish.
CHAPTER III

PREVIOUS STUDIES

Review of Theories of Aptitudes and Aptitude Testing

The study of aptitudes and aptitude tests received a large impetus by the world war as a result of studies by psychologists on the enlisted men. Since that time the movement has grown steadily. Newkirk and Green, realizing its importance, wrote:

Educational and vocational misfits, the high pupil mortality in certain of our courses, the heavy teacher burden caused by increasingly large classes, as well as the general embarrassment to the school resulting from the misapplication of abilities, all demand that more attention be given to this phase of educational measurements.  

Aptitudes like many another abstract terms has meant many things. One writer thinks of it as "native capacities" another as "ease of acquisition" and still others in terms of interest. Probably all are right in some respects and all are wrong in other respects. Aptitude in its broadest sense implies native capacities, interests and drives.

There is a tendency on the part of many to think of aptitude testing as directly measuring future accomplish-

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1 Newkirk, Louis V., and Harry A. Green, Tests and Measurements in Industrial Education, p. 83.
Aptitude tests do not directly measure future accomplishment. They make no such pretense. They measure present performance. Then, in so far as behavior, past and present is known to be symptomatic of future potentialities, the test data supply a means of estimating these potentialities. The estimate is necessarily in terms of probabilities only.²

This point is especially significant to the counselor, personnel manager or guidance director.

One feature of aptitudes which cannot be overlooked is that of special aptitudes. A person can learn to do one type thing more readily than another. This capacity to learn one type of thing easily is not necessarily stable although there is a tendency for them to persist.³

Also to be considered is the theory of individual differences. The aptitudes of individuals vary in many respects and the prediction of what one individual will do upon the basis of what others have done is highly dangerous unless all the factors are known. For example, two individuals might have approximately the same interests and drives but a wide variance in native capacity. To direct these two individuals into the same

² Bingham, Walter Van Dyke, Aptitudes and Aptitude Testing, p. 22.
³ Ibid., p. 24.
channels of endeavor would be detrimental to the one or the other.

There seems to be a tendency for an individual's traits to form a sort of normal distribution curve. The majority of his traits will group themselves around a central level with outstanding proficiencies at one end and outstanding deficiencies at the other. Thus as far as his capabilities are concerned, he has many which he could follow vocationally a few which would be possible and a few which would be highly undesirable. Here then is where interest and drive must play an important part in the decision which the counselor helps the individual make.

In order that an individual may succeed in his activities, it is important that recognition be made of his aptitudes. If an individual is unhappy in his work from whatever cause there is a distinct loss to himself in wasted effort, peace of mind and efficiency, Similarly there is a loss in his family relationships. Likewise his community, his state and society as a whole are likely to suffer a loss in his ability to make adjustments and live as a normal individual. Unfortunately too many people just happen to fall into the jobs they do with

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4 Hull, C.L., Aptitude Testing, p. 43.
the resultant losses just mentioned. How much better it would be if the individual could have his aptitudes studied, and on a basis of this study be directed towards activities in which the studies predict most personal satisfaction, and the resultant benefits to society, lies. How much better society could become were there not such a waste of human effort, so much mental disorder caused by maladjustment in vocational endeavor. Probably this is one reason why the use of aptitude testing is coming more and more to the front and new and better aptitude tests are being used in vocational counseling.

Out of problems which have arisen in the writer's teaching has developed an interest in so-called mechanical aptitude tests. Many boys have been shunted out of academic work into the shops of a school on the theory that, if he shows no apparent aptitude for academic work, he must have aptitudes for mechanics. This might be true in some cases, but it doesn't necessarily follow. While it is true that many people with no aptitude for academic work show an aptitude for working with their hands, the skilled counselor will bear in mind that as Bingham points out, there are at least two types of mechanical aptitudes. One is aptitude for manual occupations and the other is aptitudes for skilled trades which demands far more native
capacity than does manual occupations.5

Some of the early tests for mechanical aptitudes did not make this distinction. A high score on manual dexterity seemed sufficient to warrant guiding an individual into most any mechanical pursuit. The result was that many a boy who was manually dextrous entered a skilled trade in which his lack of ability to master the technical knowledge was insufficient.

About 40 per cent of all gainfully employed persons are engaged in work which demands manual dexterity of some kind.6 Thus manual dexterity tests must not be overlooked. A number of these tests take the name of performance tests. Bingham lists as examples: Kemble's Peg Board Test, O'Connor's Finger Dexterity Test, O'Connor's Tweezer Dexterity Test, Minnesota Spatial Relation's Test, Scott Three Hole Test, and Stanford Motor Skills Unit.

He suggests that these are suitable for determining manual dexterity for certain types of bench work. He also points out that the one used will depend upon a selection based upon a study of the job in mind.

5 Bingham, Walter Van Dyke, Aptitudes and Aptitude Testing, Chaps. X and XI.

6 Newkirk, Louis V., and Harry A. Green, Tests and Measurements in Industrial Education, p. 83.
Bingham lists as skilled trades "those which require more than two years of special training and experience." He also points out:

A person's aptitude for a skilled trade is in part a matter of his interests and preference; in part his facility in acquiring manual expertness in the kinds of skills required; and in part also, of his abilities in acquiring knowledge and exercising good sense in the decision he makes.

In other words it is not sufficient in counseling for a skilled trade to check the individual's intelligence and mechanical aptitude, but also his interests. Tests recommended are non verbal forms of intelligence tests such as Army Beta or Scoville Classification tests. In place of manual dexterity tests, mechanical aptitude tests are urged on the grounds that the mechanical ability needed for skilled trades includes such items as motor and sensory abilities. Such tests as: Minnesota Mechanical Assembly Test, Minnesota Spatial Relations Form Board, and MacQuarrie Test of Mechanical Ability are recommended with the preference going to the MacQuarrie Test because it tests both manual dexterity and mechanical aptitude.


Ibid., p. 128.
Symonds also gives preference to the MacQuarrie tests on the basis of high reliability and correlation with school grades in shop work.

Newkirk and Green make no reference to the MacQuarrie Tests at all but rate the Minnesota Mechanical Ability Battery very high, giving it a reliability range between its sub-tests as .77 to .94. Koos and Kefauver also rate the Minnesota Battery as the best in the field.

By way of summary, it may be said that the use of mechanical aptitude and manual aptitude tests in counseling is by no means a sure prediction. They measure accurately enough what the individual is at present, but what he will be at some future date is merely a prediction based upon an analysis of what he is at present, what he has been and what others in a similar circumstance have done. The counselor might weigh all of the data at hand and upon this basis help the individual make his decision. It must be remembered that, as Bingham puts it:


Aptitudes indicate potentialities. Aptitude tests measure abilities and interests. They ascertain what an individual actually does in certain standardized situations, and from these measurements the estimate of capacity for future accomplishment is an inference—a statistical probability, not a certainty. Moreover tests cannot sample all of the important aspects of behavior, nor plumb the depths of vocational purpose. Even with all the data at hand, an inquirer's question regarding his aptitudes can rarely be answered precisely and with positive assurance. No known scheme of interview or examination can grind out an exact solution to an equation which contains so many variables and unknowns.12

Previous Studies in Which Similar Tests Were Used

One of the earliest attempts at a serious study of the measurement of mechanical ability and its relation to other factors was that of John L. Stenquist,13 made during the years 1919 and 1920 and published in 1923.

During this period Stenquist gave to 697 boys in the public schools of New York City a series of intelligence tests composed of: the National Intelligence Tests A and B, the Haggerty Intelligence Test, Delta 2, the Otis Intelligence Test, Meyers Mental Measure, and

12 Bingham, Walter Van Dyke, Aptitudes and Aptitude Testing, p. 11.

13 Stenquist, John L., Measurement of Mechanical Ability, Teachers College Contributions to Education, no. 130, N.Y.: Teachers College Columbia University, 1923.
the Thorndike Visual Vocabulary Scale. To these same boys was also administered Stenquist's own measures of mechanical ability.

These ability tests were composed of two assembly tests known as Assembly, Series I and II, and two picture tests known as Picture Test I and II. Both assembly tests dealt with common objects such as, a clothes pin, a cupboard catch, a bicycle bell, etc., which the testee was required to assemble as rapidly as possible.

Picture Test I consisted of seventy-eight items concerning simple machines and their parts in which the testee was required to match one of five pictures with the key picture.

Picture Test II was very similar to Picture Test I in that it was essentially a test of recognition of parts of a machine. However, language usage was eliminated in the latter while the former was composed of sixty questions concerning the numbered parts of pictured machines.

Stenquist found that there was an inter-correlation of the mechanical ability tests between .60 and .70. Also it was found that the tests yielded high validity coefficient when checked against rating scales of the work of the boys who were tested. These coefficients ranged as follows: Picture Test I, .61, Picture Test II, .65.
and Assembly Test, .77. When correlated with intelligence measures the tests were found to range from .23 to .52, and when the combined correlation was obtained it was found to be .21.

From his findings, Stenquist concluded that there is a sort of mechanical intelligence or aptitude to be distinguished from general intelligence, and that ability in one neither implies nor precludes ability in the other.

In 1928 John W. Cox, published the results of his study of mechanical aptitude at the University of London. He had studied quite extensively the previous work of Stenquist and was not entirely convinced that Stenquist had proved his point. With this in mind Cox set about to formulate a new series of tests in which the element of recognition due to previous experience would be eliminated.

This new test battery was composed of five groups, namely: mechanical models, mechanical explanation, mechanical completion, mechanical diagrams, and knots.

The mechanical models test was a series of models in which the subjects were allowed to see that moving one part of the model would move another part. They were

then required to explain either verbally or by sketch how the apparatus worked.

The mechanical explanation tests were a series of diagrams with a complete description. The testees were required to answer questions involving an explanation of how the various parts operated.

The mechanical completion test was composed of eight sub-tests, six of which were similar to the explanation tests. The other two were tests in which a part of the diagram was missing and the subject was required to fill in the missing part in order to complete the diagram.

The mechanical diagrams test was simply a series of diagrams without any explanation offered. The individual taking the test was required to explain the principle on which the machine worked.

The knots test was composed of pieces of rope coiled about themselves. The testee was required to tell how many knots would be tied if the loose ends of the ropes were pulled taut. This test after a preliminary usage was discarded as being of no value.

For preliminary checking purposes the tests were administered to three age groups of commercial students. Subsequently, however, the subjects to whom the tests were given were 3 groups of elementary school boys totaling 114 cases between the ages of 10 and 14 years, 3 months, and
226 mechanics in a technical school of the Royal Air Force.

To the air force group, Cox also administered two intelligence tests. One of these tests was devised by the Department of Education of the air ministry and the other was formulated by Spearman.

With the elementary school group, Cox found a very low positive correlation between his mechanical tests and the school tests taken by the students. This correlation was only .19.

In the case of the air force group, Cox found a slightly different picture. The mechanical tests correlated positively to the extent of .64 with the final examinations given to the group after a 3 year course. The correlation of the intelligence tests with this same final examination was only .42, and the correlation between the mechanical tests and the intelligence tests was .27.

Cox concluded from his study that there is a sort of mental mechanical ingenuity, or aptitude, which is a thing apart from the factors measured by tests of intelligence. This aptitude he designated as the \( (m) \) factor. His position is perhaps best expressed in his own words:

Clearly the presence of \( (m) \) depends not only on the spatial character of the material, but also on the kind of thinking to be carried
out in relation to that material. Seeing that we avoided, as far as possible, questions which would require special knowledge or training, (m) appears to be best identified with innate aptitude for this kind of thinking.15

Herbert A. Toops,16 working with the Institute of Educational Research, published in 1923 the results of his study of tests suitable for vocational guidance for children from thirteen to sixteen years of age.

The object of this study was to examine the field of tests in three main divisions of ability to ascertain which test or group of tests was suitable for use in schools as instruments of guidance.

These three divisions are listed by Toops,17 as:

"(1) ability to deal with ideas; (2) ability to deal with things and mechanisms; and (3) the ability to deal with clerical items and procedures." He also recognized the possibility of a fourth ability, that of selling, but pointed out that there was insufficient test material available for that ability to be included in the study. The reasoning behind the use of this classification was that roughly this classification

16 Toops, Herbert A., Tests for Vocational Guidance of Children Thirteen to Sixteen, Teachers College Contributions to Education, no. 136, N.Y.: Teachers College Columbia University, 1923.
17 Ibid., p. iii
covers the range of occupations open to children from thirteen to sixteen years.

The general method of selecting the tests was to assemble the tests for each field, try them out on the same subjects, establish reliability coefficients, and find average intercorrelations. Also a success criterion was established and the validity of each test checked. The final selection was based upon the composite picture formed by a study of the data.

For ability to deal with ideas, the I.E.R. Arith.-Re.-test composed of the Thorndike-McCall Reading Test and the test in Arithmetical Problem-Solving by the same authors was recommended. However, Toops also suggested that any of the standard tests of general intelligence would be quite satisfactory.

The Stenquist Assembly Test and the I.E.R. Assembly tests, for boys and girls respectively, was the final choice of devices to measure ability to deal with things and mechanisms.

To test for ability to deal with clerical items and procedures, the I. E. R. tests of clerical ability, C-1 for the higher levels, and C-2 for the lower groups, was found to be most satisfactory.

Concerning the relationship between mechanical ability and certain other measures Toops concluded:
Taking boys and girls as we find them in the public schools, "ability with things" is notably distinct from "ability with ideas and symbols." How distinct these abilities are in the original inborn constitution of man we do not know. They may become more and more divorced by circumstances of life which give certain individuals much practice with things and little with ideas and symbols and vice versa. As things are, however, we get information about a new and large fraction of human ability when we add such a score as that in the Stenquist Assembly or the I. E. R. Assembly to a pupil's school record and score in intelligence tests.

To the existing evidence for the distinctness of these abilities our investigation adds the following:

In the general summary table of intercorrelations (Table V) we show, along with many other facts, results for 435 boys and 313 girls in the case of Half-Year Gains in School, Average Conduct in School, and Average Work in School, as related to score made in the Assembly Tests and to score made in the Arith.-Re. Test, and also the relation between the Assembly Test score and the Arith.-Re. Test score. The Assembly Test ability is clearly differentiated, especially in boys. Most of the correlations are below .25.18

It is also worthy of note that Toops found the average intercorrelation of the mechanical ability tests to be .40 while that of the tests of general intelligence was .60. This discrepancy he interpreted as:

... This rather lower intercorrelation may indicate a greater confusion in the minds of the builders of mechanical tests in regard to

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what they are attempting to measure than in the case of the builders of intelligence tests; or, it may be merely the result of the lack of sufficient mechanical environment in the case of these boys to bring out their mechanical potentialities; or lower inter-correlations of "Mechanical" tests may be the essential nature of such tests. In various other tests it has been found that practice improves the correlation between functions. It seems quite likely, once these boys are subjected to a more complicated mechanical environment, that the size of the correlations between these mechanical tests will increase. The mechanical environment of a New York City boy is quite limited compared to that of a country boy, or one living in a small town.19

Under a commission by the Commonwealth fund in 1921, Thorndike and others20 began a study of the predictive value of certain tests from the standpoint of guidance for children at about age fourteen. Thorndike has expressed the problem from which this study grew in the following manner:

The first step to the use of facts in guidance is to know their significance, their predictive value. The right use of a fact in guidance depends upon other things than its significance, but it always depends upon that. In particular, if the score made in the test in assembling a clothes pin, a paper clip, a chain, a bicycle bell, etc., does not signify


anything about how rapidly the boy will advance in school, or how well he will do in high school, or how much he will earn in a mechanical job, or how well he will like that job, or any of the other features of his career that we have recorded, it is presumably useless as a means of guidance. 21

With this thought in mind, Thorndike selected 2225 boys and girls in New York City, administered a battery of tests, and then followed the progress of these students for eight years to determine if there were any significant conclusions to be drawn from a comparison of the test results and the actual work in which the students were engaged.

The battery of tests was composed of problem solving in arithmetic, comprehension of paragraphs, abstract intelligence tests, clerical intelligence tests, clerical activities tests, Stenquist's Mechanical Assembly Tests, and the I. E. R. test of mechanical ability for girls. Other facts concerning the students at the time of testings were also assembled; including such items as age, rate of progress, conduct, school attendance and school achievement.

Eight years after the tests were given, Thorndike obtained information on the progress of 1068 of the subjects. This information consisted chiefly of facts

21 Ibid., p. 30.
concerning the type of work the student had done and was doing, expressed interest in the work in which engaged, amount of earnings, and the level which had been attained in the type of work being performed.

When this follow up information had been compiled, it was tabulated and compared with the information gathered eight years earlier. The following quotation gives the results of the comparison in respect to the tests of mechanical ability:

Among those who engage in mechanical work, success in school to age 14.0 (Items 2 and 12) and scores in intelligence tests at that age (Items 3 and 9) are nearly valueless, and nearly equally so in predicting earnings, level of work, and interest in work at age 20.0 to 22.0. The average correlation for Items 2 and 12 with earnings is .07; that for Items 3 and 9 is .04%. The corresponding correlations with level are .04; and -.01%. Those with interest are .00 and .04%. The correlations for school progress (Item 10) and grade reached at leaving school (Item 18) show the same general fact.

Marks for school conduct (Item II) give predictions at or near zero for earnings (Item 22), level of job (Item 23), and interest (Item 24), -.01, .07, -.03. School attendance (Item 13), which was influenced by a mixture of parental attitude, child’s attitude, and child’s health, gives predictions at or near zero, .00, .02, and -.07.

The score in the tests of mechanical adroitness (Item 5 or 6) had correlations of .10 with earnings (Item 22), .14 with level (Item 23) and -.07 with interest (Item 24). Items 14 and 15, derived measures of relative superiority in the tests of clerical intelligence and activities as compared with the test of mechanical adroitness (see pages 13 and 14...
for formulae), have correlations of .05 with earnings (Item 22), .12 with level (Item 23), and .07 with interest (Item 24). The score in the mechanical test is the best among our items, as is reasonable, but it is exceedingly low in predictive power.  

Thorndike interpreted this situation as:

One or both of two things must be true. Either the qualities which are productive of large earnings, high-level work, and satisfaction in the job at mechanical work at age 21.0 are very different from those which produce success in school and tests of intelligence; or the individual's nature changes so that the qualities which one possesses at 21.0 are not predictable from those which he possesses at 14.0; or both of these are true.

In any case, no combination of the facts gathered by us at age 14.0 would have enabled a vocational counselor to foretell how well a boy or girl would do in mechanical work six to eight years later, or how happy he would be at it. Estimating (somewhat optimistically) the prophecies for salary, level, and interest from the best possible multiple regression equation as .14, .16, and .12, the judgments of the counselor would have had about 98 percent as much error as if he had made them by pure guess.

Much the same result was obtained when the test battery was compared with success at mixed and clerical work. Clerical and abstract intelligence scores were found to have an average correlation of .11 with

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earnings, and with level of work a correlation of .06. Similarly, correlations with success in school work as well as that of conduct and attendance were either zero or practically so.

The general impression given by these figures was that as predicting agents the tests were practically valueless. However, as Thorndike pointed out, the lack of uniformity in employment methods among employers, especially in the case of young employees, may have entered into the picture sufficiently to unhinge the criterion of success with respect to wages, interest, and level of work. The implication is that the criteria were not valid.

During the year 1922, the National Research Council appointed a committee to study scientific problems of human migration with Robert M. Yerkes as the chairman. Yerkes then asked Richard M. Elliott, chairman of the department of psychology and Donald G. Paterson, professor of psychology at the University of Minnesota, to submit plans for a study of mechanical ability under a grant from the National Research Council. Elliott and Paterson agreed to this proposal with the result that in October 1922 work was commenced on this project. 24

Paterson and Elliott directed the investigation with the assistance of L. Dewey Anderson as chief director, Herbert A. Toops as statistical consultant and Edna Heidbreder as editor.

As a basis from which to work, it was decided that mechanical ability should be defined as, ability to manipulate tools and materials, and ability to secure information about tools, materials and their uses.

Logically then the next steps were: to determine whether mechanical ability is a single ability or a group of abilities, to find out if any relationship exists between mechanical ability and psychological traits, to ascertain if the development of mechanical ability is conditioned, and to construct an adequate test or battery of tests for the measurement of mechanical ability.

As a general working hypothesis, Paterson and Elliott formulated the theory of unique traits. This theory makes two assumptions:

...(1) that the various degrees of success in all the important classes of human behavior correspond to compounds of relatively unitary traits, combined in various proportions; and (2) that these unitary traits can be discovered and measured objectively and are probably not so numerous as to make impossible the task of measuring all of them.

According to this theory, the difference between individuals of two occupational classes can be expressed in terms of quantitative differences in a few traits. The difference between a machine
tender and a farm hand, for example, is a matter of differences in a few particulars such as physical strength, ability to resist monotony, scope of attention, mechanical aptitude, and intelligence. 25

As a preliminary experiment, Paterson and Elliott decided to try out 26 available tests which might be measures of mechanical ability. These were divided into seven groups: 1, intelligence tests, e.g., the Army Alpha and Otis S-A., Higher Form A.; 2, simple tests of motor ability, e.g., tapping; 3, balancing and equilibrium tests, e.g., body balancing; 4, complex eye-hand co-ordination, e.g., card sorting; 5, assembly tests, e.g., Stenquist's assembly tests; 6, mechanical knowledge, e.g., Stenquist's picture tests I and II, and 7, miscellaneous tests, e.g., motor inhibition and rhythm tests, etc.

The subjects used in the preliminary testing program were 217 boys of the Jordan Junior High School in Minneapolis. This school was selected in preference to others after consideration of such items as school organization, economic and social status of the personnel.

The criterion used in the preliminary work was the average grade of the boys in five shop courses. The organization of this school required that all boys take ten week courses in each of the five shops. Thus each boy was rated once by five different instructors on a previously arranged rating plan.

The reliability of these 26 tests was checked upon by means of re-testing after seven days. In general the reliability was found to be too low and the majority of the tests had to be revised.

The majority of the tests also showed a low individual correlation with the criteria of mechanical ability thus indicating low validity. However, used together in a battery, it was possible to obtain a correlation of .60 which is a fair index of validity. Also the battery showed a correlation of .07 with intelligence thus supporting the theory of the uniqueness of mechanical ability.

During the years 1924–1925, what Paterson designates as the “experiment proper” was undertaken.

The first step was to increase the reliability of the tests. In the case of the Paper Form Board test, the Packing Block test, the Card Sorting test, and Link’s Spatial Relations test, the reliability was increased by lengthening to .90, .77, .90, and .84 respectively. It
was found necessary, however, to revamp the Stenquist Assembly tests and the Stenquist Picture tests I and II, as well as the Steadiness test. In the final form these tests showed reliability coefficients of .94, .89, .90, and .93, respectively.

After revision, Link's Spatial Relations test was designated as the Minnesota Spatial Relations test, and Stenquist's Assembly tests became known as the Minnesota Mechanical Assembly test. Thus the complete battery for the second experiment became: the Minnesota Mechanical Assembly test, boxes A, B, and C., the Minnesota Spatial Relations test, Boards A, B, C, D., the Minnesota Paper Form Boards, Series A and B., the Card Sorting test, the Packing Blocks test, the Steadiness test, Stenquist's Picture tests I and II, and the Otis S.A. Higher Form A test. However, further work with the Packing Block and Card Sorting tests eliminated them from the battery since they showed a very low correlation with any of the criteria.

Like the former experiment, these tests were administered to the boys at Jordan Junior High School. This time, however, the tests were given to one hundred and fifty newly entered boys so that the element of previous experience might be eliminated as much as possible. The work of these boys was then closely followed for a period
of one year and information concerning their academic success, previous experience in mechanical work, interest, motor ability, anthropometric measures, social and economic status and home influences was obtained.

The criterion used in the second experiment was three-fold; a rating on the basis of both quality and quantity of finished products in the shop classes, results of final operation tests, and results of objective information tests. This criterion was found to have a reliability coefficient of .50.

The chief purpose of the second experiment was to discover a team of tests which could be used successfully as predictive agents. On the whole the results obtained were encouraging. With the combined quality and information criterion, the tests showed a sufficiently high correlation to warrant their use in a predictive capacity. With the combined criteria of quality and quantity, the correlations were so low as to be negligible, indicating that when the quantity element enters in, probably another unique factor is operating. With the information criterion alone, the tests show a low correlation, while the correlation between intelligence and the same criterion is high. The situation is well summed up in the words of Paterson, Elliott and others:
On the whole, the evidence is favorable with respect to the possibility of measuring mechanical ability as quality. All of the mechanical ability tests show positive relationships with the criterion, and three of them, the Minnesota Assembly test, the Minnesota Spatial Relations test, and the Paper Form Board tests, give correlations which indicate that they are distinctly successful as instruments of prediction. Furthermore, there are significant correlations between the quality criterion and some of the additional measures which might be combined with the foregoing tests in the construction of test batteries.26

One of the most recent studies in the field of mechanical ability is that made by Marian C. Pritchard27 with subnormal boys.

The purpose of this study as stated by Pritchard was:

To test by experimental methods some factors apart from intelligence which might be contributing forces in the trade training performance of sub-normal boys.28

The subjects used in this study were 79 boys in the Edenwald School for Boys which was established in 1930 by the Board of Directors of the Hebrew Orphan Asylum. These boys ranged in ages from 12 years and 1 month to 18 years, with a mean age of 14 years and 11 months. Forty per cent of these boys were delinquents.

27 Pritchard, Marian C., The Mechanical Ability of Subnormal Boys, Teachers College Contributions to Education, no. 669, N.Y. Teachers College Columbia University, 1933.
28 Ibid., p. 5
The tests used by Pritchard were: the Stanford Revision of the Binet-Simon Intelligence Scale, the Minnesota Paper Form Board, Series A and B, the Minnesota Spatial Relations Boards A, B, C, and C, the Minnesota Assembly Boxes, A, B, and C, the Hubbard Interest Analysis, the Maller Character Sketches, and the Haggerty-Olson-Wickman Behavior Rating Schedules.

The criterion selected was a project in elementary woodworking designed to cover a large range of mechanical manipulations. This project when completed by the subjects was rated by two competent instructors on a previously agreed upon rating scale. The correlation between the two ratings was found to be .95, thus establishing to a reasonable degree of certainty the validity of the criterion.

In an attempt at achieving homogeneity, the subjects were divided into four groups. Those who were doing better than average work in all shop courses were designated as "successes," those who were doing high average work were labeled "probable successes", those whose work was low average were called "probable failures", while those whose work was very poor were termed "failures". These divisions were established on the basis of shop marks and a conference with the shop instructors.

When the results of the tests were tabulated and
studied, it was found that the results obtained were very closely related to the results obtained by Paterson and Elliott \textsuperscript{29} at the University of Minnesota. When the group scores on the entire battery of tests were treated as composite scores, they correlated with the criterion as follows: intelligence quotients .003, height .13, weight .16, Minneapolis Spatial Relations Boards A, B, C, and D, .53, Minneapolis Paper Form Board, Series A and B .54 and Minnesota Assembly Boxes A, B, and C, .55. These correlations are surprisingly close to those obtained by Paterson and Elliott \textsuperscript{30} with the exception of the correlation of intelligence with the criterion. The difference, .003 found by Pritchard as compared to .21 reported by Paterson and Elliott, was explained by Pritchard as being partly due to a wider range of intelligence scores among the boys at Minneapolis.

Stating further Pritchard says:

A comparison of the criteria scores with various other measures used in the study reveals that the only measures which show a substantial or marked relationship to the criterion are

\textsuperscript{29} Paterson, Donald G., Richard M. Elliott, L. Dewey Anderson, Herbert A. Toops, and Edna Heidbreder, \textit{Minnesota Mechanical Ability Tests}, Table 59, p. 434.

\textsuperscript{30} Ibid., Table 59, p. 434.
those connected with the Minnesota Mechanical Ability Tests.\textsuperscript{31}

After comparing the results of this study with the norms established for the Minnesota Mechanical Ability Tests, Pritchard concludes:

The Mechanical Ability Tests, it would seem, serve as an instrument in discovering some individuals in a group made up entirely of mentally inferior subjects, who possess mechanical ability equal or superior to the norm for the general population.\textsuperscript{32}

\textsuperscript{31} Pritchard, Marian C., \textit{The Mechanical Ability of Subnormal Boys}, p. 53.

\textsuperscript{32} Ibid., pp. 65-66.
CHAPTER IV
THE STUDY
Number of Cases

When the results of the testing program which was carried out in connection with this study were tabulated, it was found that fairly complete returns were available for 118 cases. However, in certain instances the figures for only 89 were obtainable due to the fact that some of the boys failed to return to the Psychometric Laboratory to complete the tests.

Age of the Students

Data on the age of 118 cases were obtained. The age of this group ranged from 14 to 20 years with a heavy preponderance of cases 16, 17, and 18 years of age. In fact over 77 per cent of the total came within the age limits of 16, 17, and 18 years. Four of the boys had just reached the age of 14 years and only one was found to be 20 years old.

The mean age of the group was found to be 16.68 years with a standard deviation of 1.2 years.

Due to quite a large number of boys who had reached 18 and 19 years of age, the median for the group turned out to be 17.1 years. This is slightly higher than the mean, but, since both the median and the crude mode were
within limits of 16 years the true central tendency of the age of the boys in the Senior Division at Robert L. Sabin High School, pointed to 16 years plus.

Intelligence

Intelligence quotients were available on 107 of the cases. These quotients were computed from the Otis Self-Administering Test of Mental Ability. For the most part the higher or the intermediate forms of this test were used, although in some instances where the factors involved seemed to warrant its use, the non-verbal form was used in preference to either of the others.

The range of these intelligence quotients was found to be 55 with the lowest being 60 and the highest being 115.

The mean, median and crude mode for the group turned out to be 67.7, 67.2, and 67 respectively, while the standard deviation of the group was 10.5.

The fact that all three measures of central tendency were so close indicated that within the limits of the scores 60 to 115, the group followed rather closely the arrangement of a normal probability curve. That this was true was born out by a closer study of the frequency distribution table which, when plotted graphically, gave a curve which, although slightly skewed to the right and
slightly leptokurtic, was quite close to normal. The skewness to the right was caused by the fact that there were no cases which fell in the interval 110 to 114 and only 2 which came in the step 115 to 119. The fact that the curve was slightly leptokurtic was caused by a rather heavy grouping of scores between 75 and 99. Over 75 per cent of the cases fell within these limits.

Thus, so far as the scores on the Otis tests of intelligence were concerned, the group seemed to fall into a somewhat normal distribution within the range of 60 to 115 but with central tendency somewhat below the middle of the range.

Similarly, the group scored low on the Pressey Senior Classification test. The scores for the entire group were ranged between the 5th and the 80th percentile. The mean percentile score was found to be 39.9 with a standard deviation of 17.86.

Further examination of the distribution table disclosed that 76 per cent of the cases fell below the median for the test and the heavy grouping around the central tendency again appeared as was shown by the fact that 64 per cent of the cases fell between the 20th and 49th percentile.
Language Ability

On the Johnston O'Connor Vocabulary Test, the 115 boys who were tested scored pretty low. According to the norms established for this test, a raw score of 88.5 falls at the 50th percentile or the median for the test. The highest raw score obtained by the group from the Robert L. Sabin High School was 84 while the lowest was 18. The mean raw score for the group was 47 with a standard deviation of 11.6. The available norms for this test do not provide for scores as low as this, however, if the scale were continued down proportionately, the mean score of 47 would give a vocabulary age of 8.25 years, or roughly one-half of what it should be.

There was some doubt in the mind of the writer if this test was suitable for high school students because of its difficulty. Questioning of the staff members at the Psychometric Laboratory seemed to substantiate this doubt since they reported that in the cases of most of the subjects whom they had tested, the scores were low also.

In the English usage test, the scores made by the subjects of this study were low when compared with the scores made by 1200 young men who had previously been tested at the Psychometric Laboratory. This group had a mean score of 44.9 with a standard deviation of 4.75, and a mean age of 18 years. The group from Robert L. Sabin
High School had a mean score of 39.5 with a standard deviation of 5.13. There was a difference of only 5.47 points in the central tendencies of the two groups. This did not appear to be significant until further study of the distributions was made. This study revealed that whereas 42 per cent of the group of 1200 missed 2 or less of the sentences, only .8 per cent of the subjects of this study missed as few as 2 or less.

There are no norms available for this test but on the basis of the performance of the group of 1200, the group from the Robert L. Sabin High School did not make a good showing.

However, it is within the realm of possibility that there is a positive relationship between measures of intelligence and measures of language ability. That this might be the case is suggested by the study made by Murdock, Maddow and Berg with 149 school girls in New York City. A correlation coefficient of .62 was found to exist between their scores on the Otis intelligence tests and the Thorndike Word Knowledge Test.

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Mechanical Ability

Manual dexterity was tested by means of the Minnesota Manual Dexterity Test. One hundred eighteen boys took this test which is designed to test rapidity and control of hand and arm movements. The test was scored in terms of seconds to complete the test and then translated into percentile rankings according to established norms.

When the percentile scores were arranged in a frequency distribution table, it was found that the range extended from the first to the 94th percentile, with the heaviest groupings coming between the first and the 30th percentiles.

The mean percentile score was found to be 35.26 with a standard deviation of 25.52. This mean is approximately 15 points below the mean norm for the test.

It was also found that 60 per cent of the cases fell below the 40th percentile, about 20 per cent came between the 40th and 60th while about 20 per cent exceeded the 60th percentile.

In common language, these figures showed that in the group tested, roughly 20 per cent of the cases were manually dextrous, about 20 per cent were average, while approximately 60 per cent showed a decided slowness of movement and lack of muscular control.

Probably a part of this slow group could be accounted
for by the fact that many of the boys were physically immature and lacked control of the big muscles involved in the movements.

The O'Connor Finger Dexterity Test, which was used to test rapidity and deftness of finger movement, showed slightly higher results than did the test of manual dexterity. The 116 boys who took the test made a mean percentile score of 45.26 with a standard deviation of 23.37. This mean score was only 4.74 points below the mean norm for the test and was accounted for by a rather heavy distribution between the 20th and 30th percentiles.

The frequency distribution table further revealed that 29.7 per cent of the cases scored above the 60th percentile, thus showing finger dexterity to a marked degree, 29.7 per cent made scores between the 40th and 60th showing themselves to be average, while 40.6 per cent were slow and clumsy.

The element of immaturity also would enter into this picture although apparently to a lesser degree since, in general, the boys appeared to have had better control and speed in the use of the smaller muscles.

The O'Connor Tweezer Dexterity Test was very similar to the finger dexterity test, excepting that the use of an instrument had been added. The factors of rapidity of
movement and muscular control remained constant. Here again the range in scores was from the first percentile to the 99th.

The mean percentile score was found to coincide almost with the mean for the test, being 50.86. However, the standard deviation of 28.09 showed a far from normal spread. Analysis of the distribution table showed a heavy grouping at each extremity of the table with a relatively small group located around the mean of the test. Forty-four per cent of the cases scored above the 60th percentile, 36 per cent of the cases scored below the 40th percentile while only about 20 per cent were grouped between the 40th and 60th percentiles. Thus the figures showed a decided tendency for the group to be either very dextrous with a small instrument or very slow and lacking in control.

On the Minnesota Mechanical Assembly Tests, Boards A, B, C, and D, the 118 boys being studied scored slightly above the mean for the tests. The mean percentile score for the group was found to be 57.72 with a standard deviation of 27.47 and a spread between the first and 99th percentiles.

Study of the distribution table shows a heavy grouping of cases above the 60th percentile and quite large groupings below the 40th. There seemed to be a tendency
on the part of this group to be either good or poor at assembling, with only a sprinkling of cases around an average. That this was the case was shown by the fact that there was found to be only 12 per cent of the cases between the limits of the 40th and 60th percentile. Twenty eight per cent of the group scored below the 40th percentile while the balance, 60 per cent scored above the 60th. The heaviest grouping by far ranged between the 60th and 69th percentile.

The fact that the group from the Robert L. Sabin High School exceeded the mean for the test might be accounted for by the factor of previous training. In designing the test, the makers eliminated this factor as far as possible. The majority of the cases examined in this study have had at least 2 years of industrial arts experience. Possibly this experience might tend to raise the average of the group.

The scores of the 118 boys under consideration were high also on the Minnesota Spatial Relations Test. The mean percentile score for the group was found to be 70 with a standard deviation of 25.7. The range extended from the first to the 99th percentile with a heavy preponderance of cases falling between the 50th and 99th percentile. Further examination of the distribution table revealed that no less than 75 per cent of the cases scored
above the 60th percentile.

That any group selected at random should score so far above the mean of a standardized test was somewhat surprising. However, the fact that these boys have all had considerable training in Industrial Arts classes may have introduced a previous experience factor which made a selected rather than a random group.

The Johnson O'Connor Wiggly Block Test was designed to test recognition of structural relationship in three dimensions. On this test the group from Robert L. Sabin High School made a mean percentile score of 49.33 with a standard deviation of 31. Although this score was very close to the mean of the test, the size of the deviation score indicated a far from normal distribution. By far the heaviest groupings fell between the first and the 20th, and between the 80th and 100th percentiles. The frequencies in these two ranges was 30 and 32 respectively while only 14 cases scored between the limits of the 40th and 60th percentile.

This condition indicated a tendency for the group to be arranged in only two classifications, good or poor. In fact, the distribution tables showed 51 cases who scored above the 60th percentile and 53 cases who scored below the 40th.
Personality

The Bernreuter Personality Inventory was given to 89 of the boys from the Robert L. Sabin High School. Coming as the boys did from almost every section in the city, and with different training and backgrounds, it was not surprising that almost the entire range of each section of the test was represented.

In neurotic tendency, the mean percentile score was 52.9 with a standard deviation of 23.13, which is only slightly higher than average. However, when the distribution table was studied, there was evidence of a slight tendency towards neuroticism. Forty per cent of the group were found to have scored above the 60th percentile, 32 per cent grouped themselves between the 40th and 60th percentiles, while 28 per cent of the group fell below the 40th percentile. Roughly, then, 40 per cent were found to have neurotic tendencies, 30 per cent were normal and 28 per cent were found to be rather stolid.

On the self-sufficiency side of the picture, the entire range between the 2nd and the 90th percentile was represented. The mean percentile score was 36.18 with a standard deviation of 23.15. The heaviest groupings in the distribution came below the 40th percentile. In fact 60 per cent of the cases were so distributed. This indicates a general tendency of the group to dislike
solitude, and to seek advice and help. However, the heavy grouping in the lower percentiles was not a healthy sign, being suggestive of lack of self-drive and initiative.

On introversion-extroversion, the mean percentile for the group 51.59, standard deviation 23.63, was approximately the mean for the scale. The distribution table revealed a high equality of spread over the entire distribution. Thus, although the mean for the group was close to the mean for the inventory, the group came nowhere near approaching the normal distribution. In other words, the group contained approximately an equal number of introverted, normal, and extroverted individuals.

In the personality traits of dominance and submission, the group made a mean percentile score of 44.5 with a standard deviation of 27.4. Here again while the mean score approached the mean for the test, the standard deviation indicates an unusual spread. A heavy grouping of frequencies was found to exist in the lower brackets with relatively few occurring in the higher. Actually 60 per cent of the cases scored below the 40th percentile while the remaining 40 per cent were divided about equally between the 40th and 69th and between the 70th and 100th percentiles.

Roughly then 60 per cent of the group proved to be submissive, 20 per cent were about average and 20 per cent
were found to have dominant personalities.

On the self-confidence side of the picture, the mean for the group was found to be 52.03, or just slightly above the norm for the test. This central tendency would indicate that the group was pretty close to normal in this respect. However, the standard deviation for this group was found to be 24.69, and a study of the frequency distribution table brought other facts to light. Thirty-seven per cent of the cases were found to fall between the 40th and 59th percentile while 35 per cent of the cases scored higher and 28 per cent scored lower than the mean.

This means that roughly one-third of the boys possess a normal amount of self-confidence while roughly one-third are very lacking in self-confidence, and one-third are self-confident to an excess. It is also worthy of note that in the group lacking self-confidence the distribution table indicated that over one-half of the cases were probably suffering from self-consciousness and feelings of inferiority.

In the matter of sociability, the group as a whole made low scores as is indicated by the percentile mean of 37.4. Study of the frequency distribution, however, revealed a standard deviation of 27.34. This large deviation from the mean was brought about by an
exceptionally heavy distribution in the intervals below the 50th percentile and a gradual tapering off of distributions above the 50th. The range included everything from the 1st to the 96th percentile. Fifty-eight per cent of the scores fell below the 40th percentile score for the test, 22 per cent were about average and 20 per cent exceeded the 59th percentile.

This means that roughly one-fifth of the cases tend to be solitary and non-social, one-fifth are about average, while three-fifths tend to be very highly social and gregarious. This high degree of sociability in a large number of cases conceivably could be a sign of immaturity in these boys and a hold-over of the gang spirit of pre-adolescence. The writer's personal observations lend credulity to this theory.

**Visual Acuity**

The results of the Bett's Visual Acuity Test confirm an opinion that the writer has held for sometime concerning the boys at Robert L. Sabin High School; namely, that many of them do not see properly. This test was scored simply as either pass or fail for each of the items. In three of the items over 40 per cent of the cases failed.

On test I which is a simple test to determine if the
subject can see with each eye only one student failed.

In Test II which determines whether objects seen with the left eye fuse properly with the same object seen with the right eye when the eyes are used together, about 42 per cent of the scores were failures. This test is used on small objects beyond arms reach.

Test III is a test of visual efficiency to determine if the eyes used together and then each separately record the same thing. About 14 per cent failed using both eyes, 31 per cent failed using the left eye alone and 19 per cent failed on using the right eye alone.

Number IV, the test for vertical imbalance, disclosed 12 per cent of failures. This means that 12 per cent of the cases really see 2 objects, one slightly above the other, when looking at one object with both eyes.

In the test of depth perception, test number V, 25 per cent of the cases were unable to distinguish which objects were standing out from a background. However, this particular test is not very reliable as it is only supposed to be 25 per cent efficient and is much simpler than the test for this eye defect which is used by the Civil Aeronautics Authority Examining Board.

On Test number VI, the test for lateral imbalance beyond arms reach and then within arms reach 8 per cent and 14 per cent of the cases respectively failed to pass.
This means that beyond arm's reach 8 per cent of the students saw two objects, one beside the other, when looking at a single object with both eyes. Similarly within arm's reach 14 per cent of the cases saw double.

Test number VII is a test of fusion at reading distance and is really a repetition of test II excepting for the distance involved. The objects on the screen failed to fuse properly for 44 per cent of the students when viewed at reading distance. This means that 44 per cent of these students would find a printed page blurred.

On test number VIII which is a sharpness of image test, 14 per cent of the cases failed when the object was within arm's reach, and with 42 per cent the image was blurred beyond arm's reach.

One case only was found to be partially color blind, and only 18 per cent were found to be free from defects determinable by this test.

Vocational Interest

Ninety-one of the boys from the Robert L. Sabin High School took the Van Allyn Interest Questionnaire. This questionnaire is designed to locate primary occupational interests. In a counseling program, the three highest interests for each student are recorded and then the key is used for interpretation after taking into
consideration all of the student's personal factors. For the purposes of this study, only the primary interest areas have been recorded and analyzed. The interests expressed by each student were reduced to the three highest for each case. Then each of these expressed interests was recorded once for each time it appeared as one of the three highest for each pupil. This gave a form of distribution table from which it was possible to determine how many times the 91 cases expressed a preference for the type of work covered by each area.

The area for which preference was most frequently expressed was working with materials. In fact 31 subjects or slightly over one-third of the boys expressed preference for this type of work. Second place in order of preference went to the care and rearing of animals with 23 cases reporting an interest in this area. The third choice was for the area which involves use of physical sciences for which 21 cases expressed a preference. A three-way tie for 4th place occurred between the areas involving recreational activities, biological sciences, and mechanics with 16 cases reporting in favor of each. Fifth place with 17 preferences went to manual arts. In this area Van Allyn includes such items as sketching, drawing, modeling, designing, arranging lighting effect, cartooning, carving, etc.
Sixth place was shared between aviation and work which entails being in isolated places with 16 cases expressing a preference for each.

Administrative work, clerical work, and operating machinery shared 7th place with 14 expressed preferences for each. The remaining areas were chosen in the following order: speech and mathematics, 8 choices; music, 7 choices; travel and transportation, 5 choices; foods, language, religion and writing, 4 choices; health and healing, 2 choices; clothing and textiles, 1 choice; while printing and personal services received no votes of preference.

From the standpoint of central tendency of interests, the curriculum at Robert L. Sabin High School is satisfying the 3 chief interests of the students in two respects, that of adequate Industrial Arts courses in working with materials and physical sciences as utilized in the general science courses. However, no satisfaction is afforded in the fields of rearing and caring for animals. Here perhaps is an opportunity for curriculum enrichment in the form of extra-curricular activities or 4 H club activities.
CHAPTER V
SUMMARY AND RECOMMENDATIONS

Summary

Since 1936, when the present Robert L. Sabin High School was founded under the name of the Thomas A. Edison Six-year High School, there has been much confusion and misunderstanding in the Portland school system concerning what type of students were enrolled at this school. As a result of this misunderstanding and confusion, there has been a certain undesirable stigma attached to the school and to the students who attended. It has been the purpose of this study to clarify some of the misconceptions concerning this school by showing just what type of students have been in attendance.

In order to present a fair picture of these students the writer decided to show the nature and capabilities of the boys by means of standardized tests in the fields of intelligence, language ability, mechanical ability, personality, interest and visual acuity.

Since the facilities for administering these tests were not available at the Robert L. Sabin High School, the assistance of Robert Goetz and his staff at the Psychometric Laboratory was obtained. The tests were then administered to a random sampling of students comprising roughly one-third of the Senior Division.
In the matter of intelligence, the group was found to be distributed fairly close to a normal probability curve within the limits of 60 and 115 on the Otis tests and between the 5th and 80th percentile on the Pressey test. The central tendency in such a case would naturally be sub-normal which is what was found to be the case. Seventy-eight per cent of the cases fell within the limits of 75 and 99 on the Otis test and 64 per cent of the cases were distributed between the 20th and the 49th percentile on the Pressey test.

In language ability the subjects of the study were found to have a mean vocabulary age of 8.25 years while the scores on the English Usage test were also found to be relatively low.

In the field of mechanical ability, the general tendency of the group showed poor performance on the dexterity tests. However, the tendency of the group was toward excellence in assembling, recognition of spatial relationship and recognition of relationship in three dimensional structure.

In manual dexterity about 52 per cent of the cases fell below the 30th percentile. In finger dexterity 40 per cent of the cases fell below the 40th percentile. In the Tweezer Dexterity Test the group showed a distribution in which about 36 per cent of the cases were
below average and 41 per cent were above average.

In mechanical assembly 60 per cent of the cases scored above the 60th percentile.

In the Spatial Relations test 75 per cent scored above the 60th percentile.

On the Wiggly Block Test the mean score for the group was close to the average score for the test but analysis revealed a tendency toward either excellence or paucity of skill with very few scores being average. Forty-five per cent of the cases made scores below the 40th percentile and 43 per cent exceeded the 60th.

In the field of personality adjustment no definite pattern for the entire group was discernable. Roughly 40 per cent of the cases had neurotic tendencies, 30 per cent were found to be normal and 30 per cent were highly stable.

The central tendency in self-sufficiency was found to be low thus indicating a dislike on the part of the subjects for solitude and a tendency to seek advice and help. Also the heavy groupings found in the lower percentiles is suggestive of a lack of initiative.

An approximately equal number of cases were found to be introverted, normal and extroverted on the introversion-extroversion side of the personality picture.
In the dominance-submission scale, 20 per cent were about average while 60 per cent were inclined to be submissive.

In the element of self-confidence, the group was roughly divided into three equal groups, one average, one highly confident and one lacking in confidence. Approximately one-half of the low self-confidence group probably were suffering from feelings of inferiority.

In sociability the distribution was roughly 1, 1, 3. Only one-fifth of the cases were found to be non-social, one-fifth were about average while three-fifths of the group were highly social.

The case for visual acuity can best be summarized by pointing out that only 18 per cent were found free from defects discernable by the Bett's Visual Acuity Test. Only one case was found who lacked vision with both eyes and only one was partly color blind. The balance of the 82 per cent all had eye defects which probably are remedial.

The three highest vocational interests in order of magnitude were found to be: working with materials, working at the care and rearing of animals and work involving use of physical sciences. Working with materials was by long odds the most popular choice. Slightly over 30 per cent of the subjects expressed a preference for
In the light of the findings of this study, the writer respectfully offers the following recommendations:

1. that, because of the low central tendencies found in the fields of intelligence and English ability and because of the high correlation which has been found to exist between these fields, a study be made to determine if the low English usage is responsible for the low intelligence scores made by the group or vice versa. Whatever the findings might be, they would point out a path of procedure;

2. that a program of aptitude testing be carried out and the results used in the counseling program. It seems to be essential from the standpoint of efficiency and also from the standpoint of human behavior that special aptitudes be sought out and developed, and that individuals with no aptitude for a given subject be spared the discouragement of not being able to cope with a situation which is beyond their capacities;

3. that, the present size of classes be maintained or reduced in numbers in order that instruction may be individual; thus affording an opportunity for the correction or improvement of some of the personality
defects which this study has revealed;

4. that more extra-curricular activities be organized as a means of promoting self-confidence and self-sufficiency which this study has shown to be lacking in the group.

5. that, an effort be made to secure the services of a competent eye specialist and that pressure be exerted to have sight corrections made when needed.

6. that, because of the interest shown, the present emphasis upon working with materials and physical sciences be continued, and, that an attempt to satisfy the desire to work with animals be given expression through the organization of 4-H Clubs or similar extra-curricular activities.
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