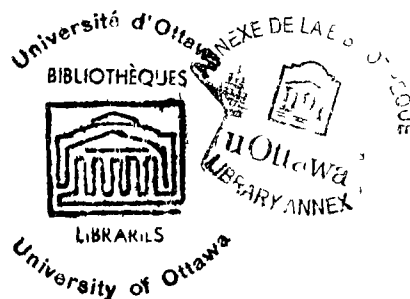


LOCAL COLLEGE PREDICTION
WITH THE OTIS AND THE OTIS-OTTAWA

by Raymond F. Vaillancourt

Thesis presented to the Faculty of Arts
of the University of Ottawa through the
School of Psychology and Education in
partial fulfillment of the requirements
for the degree of Master of Arts.



Ottawa, Canada, 1955

UMI Number: EC55413

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.



UMI Microform EC55413
Copyright 2011 by ProQuest LLC
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

ACKNOWLEDGEMENT

This thesis was prepared under the guidance of the Director of the School of Psychology and Education, Reverend Father R.H. Shevenell, O.M.I., whose advice and encouragement have been invaluable.

Gratitude is expressed to the University Authorities, particularly to the Rector and the Registrar, who kindly granted the writer access to the academic records on file in the Office of the Registrar. Thanks are also due to the staff of the Secretariate for their generous assistance.

The writer is also indebted to the Director of the Guidance Centre for making available to him the psychological test results of the subjects of the study.

CURRICULUM STUDIORUM

Raymond Fernand Vaillancourt was born at Laconia, New Hampshire on November 17, 1926. He attended the University of Ottawa where he graduated, in 1950, with the degree of Bachelor of Arts. This same institution also conferred upon him, in 1951, a Baccalaureate in Education, and, in 1953, the Bachelor of Science degree.

TABLE OF CONTENTS

Chapter	page
INTRODUCTION	vii
I. REVIEW OF THE LITERATURE	1
1. Tests of general mental ability	2
2. Measures of high school achievement	7
3. Non-intellective traits	10
4. General evaluation of past studies	13
II. THE CONDITIONS OF THE SURVEY	15
1. The measuring instrument	15
2. The situation at the University of Ottawa	19
3. The population sampled	24
III. THE DESIGN OF THE SURVEY	28
1. The collection of data	28
2. The <u>Otis</u> measure used	29
3. Evaluation of college achievement	32
4. The method of comparison	38
IV. OBSERVATIONS AND FINDINGS	42
1. The variability and overlap of talent	42
2. The relationship between aptitude and achievement	52
3. A graphic approach to prediction	56
CONCLUSIONS	67
BIBLIOGRAPHY	69
Appendix	
1. OVERLAP IN FRESHMAN COLLEGE ACHIEVEMENT	71
2. RAW DATA OF THE SURVEY	75
3. HETEROGENEITY OF APTITUDE OF COLLEGE UPPERCLASSMEN	86
4. ABSTRACT OF <u>Local College Prediction with the Otis and the Otis-Ottawa</u>	90

LIST OF TABLES

Table	page
I. - Frequency of <u>Otis</u> IQs Distributed by Category of Freshman College Achievement	44
II. - Frequency Distribution of <u>Otis</u> IQs Obtained by University of Ottawa College Graduates . .	46
III. - Frequencies and <u>Otis</u> IQs Classified According to Category of Achievement by College Class .	48
IV. - "t" Ratios Testing Differences Between Mean <u>Otis</u> IQs of Various Categories of College Achievement Arranged by Class	49
V. - Variance Ratios Testing Differences Between Several Categories of College Achievement Arranged by Class	50
VI. - Observed and Expected Frequencies of College Freshmen Classified by <u>Otis</u> IQ and Category of Achievement	53
VII. - Cell Square Contingencies for the Computation of Chi-Square for College Freshmen Classified by <u>Otis</u> IQ and Category of Achievement	54
VIII. - Frequency Distributions, and Raw and Smoothed Proportions Cumulated by Successive Upper Categories of Freshman College Achievement Classified According to <u>Otis</u> IQ	58
IX. - <u>Otis</u> IQ in Grade 12 and Subsequent Academic Achievement by College Class	76
X. - Frequency of <u>Otis</u> IQs Distributed by Category of Sophomore College Achievement	87
XI. - Frequency of <u>Otis</u> IQs Distributed by Category of Junior College Achievement	88
XII. - Frequency of <u>Otis</u> IQs Distributed by Category of Senior College Achievement	89

LIST OF FIGURES

Figure	page
1. - Raw and Smoothed Proportions Cumulated by Successive Upper Categories of Freshman College Achievement Classified According to <u>Otis</u> IQ	63

INTRODUCTION

Prognosis has been the constant concern of educational systems and institutions practically from their founding. Particular efforts have been made to predict scholastic achievement. That this goal has not been fully attained is indicated by the number of studies undertaken and the variety of their approaches¹. Moreover, no universal solution can be proposed; circumstances being specific to each institution, this essentially local problem requires its own individual solution². Therefore, in accordance with these findings, it is not only defensible but even necessary to examine the question of forecasting college success at the University of Ottawa.

The purpose of this study is not, however, the investigation of all those factors which, being associated with academic success in college, permit its prediction. The topic under consideration is much more restricted. It seeks to determine the value of the Otis Self-Administering Tests of Mental Ability in predicting college success at the University of Ottawa.

¹ Leo F. Cain, John U. Michaelis and Alvin C. Eurich, "Prognosis", in the Encyclopedia of Educational Research, revised edition, New York, Macmillan, 1950, p. 874-892.

² T.D.D. Quaid, "A Study in the Prediction of College Freshman Marks", in the Journal of Experimental Education, Vol. 6, No.3, issue of March 1938, p. 350.

There is a pressing need for investigation of a predictive nature in the academic field in order to improve education and to promote the welfare of the individual and of the country at large. This thought was admirably expressed by Dean Johnston³ of Minnesota when, in pioneering a program of educational selection, he very forcefully sketched its outcome:

What could be accomplished by all this? Several hundred students each year in each state university, and students in other colleges as well, could be relieved of the disappointment, the waste of time and money and the discouragement which they now suffer through no fault of their own. They could be helped to find and prepare for some occupation that would bring them satisfaction and happiness.

The faculties could devote more attention to capable students. There is need of very great improvement in this field of higher education. Capable students would find competition and stimulation in the class room keener, interest in studies would increase and a higher order of training would be secured.

Students of greater capacity would fill the places of those lacking in aptitude and the university or college would operate on a higher plane.

The funds now devoted to supplying teachers, class rooms, books and laboratory equipment for those who are unable to profit by these things would provide for people who can use them to advantage and whose training would return dividends to the state. The object of such plans is not to save money but to make better use of it, to get a better product from the universities, to make the world a better place to live in.

The benefits of a true and just method of selection would be greatest of all to those who would be advised to stay away from college⁴.

³ J.B. Johnston, "Predicting College Success for the High School Senior", in the Educational Record, Vol. 9, No.1, issue of January 1928, p. 17-25.

⁴ Id., op. cit., p. 25.

If the situation at that time called for selection, how much greater is the need today? It is all the more important now that the population has grown so rapidly and the standard of living has risen to enable proportionally more students to afford college education. Moreover, the need for educational selection is greater now that college training is a prime requisite of most professional and technical jobs, and that college courses have become increasingly specialized.

The situation is urgent when one considers the anticipated shortage of educators and the already inadequate school facilities. In spite of large-scale training programs and the expansion of existing facilities, conservative estimates of population growth and requirements indicate that educational supply will still fall short of demand. In the face of this impending crisis, it would appear that the selection of college students would be a necessary step towards efficiency for the benefit of the school, the faculty, the students, and society in general.

If, according to McNeely⁵, the first year of college is the eliminative year, it follows that there is a considerable waste of effort and facilities upon failing

⁵ John H. McNeely, College Student Mortality, Bulletin 1937, No. 11, Washington, U.S. Office of Education, 1938, p. vi-112.

students who are thereafter lost to the institution. To a lesser extent, subsequent years also serve as hurdles to eliminate the unsuccessful candidates. If notice is taken that progressively fewer new students enter the system in the upper classes, this becomes a matter of the greatest importance to the very survival of the college, especially if it is neither subsidized nor heavily endowed. For every failing freshman lost to the school, there is also lost in most cases, by absence of a replacement, a successful candidate for the entire four year course. In other words, the school has collected fees for one year and has provided its services to little or no avail, whereas instead it could have chosen a successful candidate who would have increased the college's revenues for three additional years and who would have used his training more profitably. Another result of having more students of superior quality, and retaining them for the duration of the whole program of studies, would be to raise the educational standards, and to increase the prestige of the institution.

Where inadequate student selection exists, it is not uncommon to find the burden of the faculty increased⁶.

⁶ The President's Commission on Higher Education, "Staffing Higher Education", Vol. 4 of Higher Education for American Democracy, Washington, Superintendent of Documents, December 1947, p. 57.

The quality of instruction may then deteriorate with consequent loss to both the school and the student.

From the guidance standpoint, perhaps the primary beneficiary of a good method of selection is the selectee himself. So often it happens that the applicant for admission to college is quite unaware of the conditions necessary to assure scholastic success. The very fact of selection tends to impress upon the accepted student the seriousness of the undertaking and its competitive nature, both of which factors tend to be highly motivational. Yet, it is particularly the rejected applicant who profits most by being apprised of his very poor chances for college success and who, as a consequence, can channel his efforts into more personally suitable activities ensuring a greater measure of success and satisfaction.

Undoubtedly, no college can afford not to make use of some means of selecting its student body. Every school has a more-or-less well-defined policy on admissions which produces a certain amount of satisfaction. The point is to discover how this degree of satisfaction can be increased.

Before developing this subject, it would be helpful to examine the more significant research findings in the academic field in so far as they concern the prediction of college success. This review of the literature will naturally lead to the design of the survey.

CHAPTER I

REVIEW OF THE LITERATURE

The usual approach to the problem of forecasting academic success in college has been correlational in nature. Once the degree of correlation, simple or multiple, has been ascertained, it is customary to make use of the corresponding regression equation to do the actual prediction. The most frequent criterion of college achievement seems to be freshman grades. To this have usually been compared, singly or in various combinations, such data as the results of intelligence tests, specific aptitude or achievement tests, and high school grades. Recently there has developed a trend to include measures of a non-intellective type, such as personality traits, interests, motivation, and study habits. The choice of elements studied depends on the type of pupil personnel work involved, guidance or selection.

Regardless of their point of view or purpose, these research findings deserve notice. Because of their number, only the more significant and representative studies will be considered. Since their nature and scope vary widely, they will be grouped under the following headings: a) tests of general mental ability; b) measures of high school achievement; c) non-intellective traits. This classification

is not inflexible as some studies of a composite nature overlap these divisions considerably.

1. Tests of General Mental Ability

Whether because of its widespread use, its frequent revision, the prestige of its authors, and/or its multiple score feature, the Psychological Examination of the American Council on Education¹ has been the most frequently used mental test with which to predict academic achievement in college. It will not be surprising then to find this brief survey heavily saturated with the results of inquiries using the A.C.E.

a) Over-all prediction. -- Whereas most studies of college achievement aim to forecast degrees of academic success, Traxler² attempted to determine the mental ability required for college admission. He analyzed the A.C.E. scores, converted to Otis IQs, of students of 323 colleges. On the basis of calculation of medians, and first and third quartiles in each institution, he then derived norms for

1 Carl I. Hovland, reviewing "American Council on Education Psychological Examination for High School Students", in The Third Mental Measurements Yearbook, Oscar Krisen Buros, editor, New Brunswick, N.J., Rutgers University Press, 1949, p. 298-299.

2 Arthur E. Traxler, "What Is a Satisfactory IQ for Admission to College?", in School and Society, Vol. 51, issue of April 6, 1940, p. 462-464.

various types of colleges. The main value of this project lay in pointing out the difference in IQs required by different colleges and by different types of colleges.

Along similar lines, Freeman³ sought to determine the extent to which the A.C.E. indicated the possibility that a student would satisfy college requirements and continue as a student. He observed that, despite a low correlation between A.C.E. decile groups and college marks, there was a definite tendency for students in the higher decile groups to achieve better averages, to encounter fewer scholastic difficulties, and to survive a greater number of terms. He judged this tendency to be insufficiently marked to warrant the exclusion of a student on the basis of the mental test alone, because nearly half of those in the lowest category succeeded in completing the course, although half of this number did so only after great difficulty. He concluded:

If our results are typical, it must be stated that the mental tests are inadequate as selective instruments at the college level, just as any other single criterion is inadequate. Yet they have a contribution to make, and on that basis their employment is justifiable⁴.

³ Frank S. Freeman, "Predicting Academic Survival", in Journal of Educational Research, Vol. 23, No.2, issue of February 1932, p. 113-123.

⁴ Id., op. cit., p. 123.

Much the same conclusion was reached by Deridder⁵ in examining the relationship between A.C.E. scores and college success. He declared the A.C.E. to be somewhat predictive of college survival. He observed that probationary students in general scored lower, but he was quick to state that low scores did not insure failure, nor did high scores guarantee success. Because of considerable overlap in test scores, he concluded that results of aptitude tests differentiate only moderately well between the successful and the unsuccessful.

On the other hand, Carter and McGinnis⁶ discovered that the Ohio State Psychological Examination clearly differentiated college freshmen having lowest and highest point-hour ratios.

b) Differential prediction. -- Inquiring into the value of a test of general mental ability in foretelling success in particular academic subjects, Segel⁷ found tests

⁵ Lawrence M. Deridder, "Relation between Gross Scores on the A.C.E. and Academic Success", in Journal of Educational Research, Vol. 46, No.5, issue of January 1953, p. 353-358.

⁶ Homer L.J. Carter and Dorothy J. McGinnis, "Some Factors Which Differentiate College Freshmen Having Lowest and Highest Point-Hour Ratios", in Journal of Educational Research, Vol. 46, No.3, issue of November 1952, p. 219-226.

⁷ D. Segel, "Differential Prediction of Scholastic Success", in School and Society, Vol. 39, issue of January 20, 1934, p. 91-96.

of specific aptitude to be better than tests of general aptitude as differential predictors. Thompson and Haines⁸ reported similar findings when they observed that the Linguistic and Quantitative sub-test scores on the A.C.E. gave slightly higher coefficients of correlation with literary and numerical subjects respectively than did the Total test score.

Remmers, Elliott, and Gage⁹ went one step further: they concluded that the A.C.E. was not as good a predictor, even when broken down to Linguistic, Quantitative, and Total scores, as were specific aptitude tests in language, mathematics, and science. It can be seen that, concerning differential prediction by means of the A.C.E., reports are by no means in agreement.

Brown¹⁰ asserts that the A.C.E. has low predictive value. The Linguistic score predicts linguistic subjects

⁸ Louise M. Thompson and Eleanor M. Haines, "The Relation of College Aptitude Scores to Performance in College Courses", in Canadian Journal of Psychology, Vol. 1, No.1, issue of March 1947, p. 37-40.

⁹ H.H. Remmers, D.N. Elliott, and N.L. Gage, "Curricular Differences in Predicting Scholastic Achievement: Applications to Counselling", in Journal of Educational Psychology, Vol. 40, No.7, issue of November 1949, p. 385-394.

¹⁰ Hugh S. Brown, "Differential Prediction by the A.C.E.", in Journal of Educational Research, Vol. 44, No.2, issue of October 1950, p. 116-121.

to an average extent, but there is hardly any difference between Quantitative and Linguistic scores in forecasting results in quantitative subjects: in fact, for this purpose the Total score is better than the Quantitative score! Osborne¹¹ and his collaborators reported that A.C.E. Total scores were more effective predictors than the Quantitative and Linguistic scores, and that Linguistic scores are consistently superior to the Quantitative in predictive efficiency.

Lanigan¹² reported some significant correlations between the Otis and various subject areas, although she found the A.C.E. yielded slightly higher correlations with course grades than did the Otis. In his study, Quaid¹³ found the Ohio State Psychological Examination a more satisfactory instrument of scholastic prediction than the A.C.E.

11 R. Travis Osborne, Wilma B. Sanders, and James E. Greene, "The Differential Prediction of College Marks by A.C.E. Scores", in Journal of Educational Research, Vol. 44, No.2, issue of October 1950, p. 107-115.

12 Mary A. Lanigan, "Effectiveness of the Otis, the A.C.E., and the Minnesota Speed of Reading Tests for Predicting Success in College", in Journal of Educational Research, Vol. 41, No.4, issue of December 1947, p. 289-296.

13 T.D.D. Quaid, "A Study in the Prediction of College Freshman Marks", in Journal of Experimental Education, Vol. 6, No.3, issue of March 1938, p. 350-375.

These reports have centered around the A.C.E. and its competitors. Other tests must have been used in the same way, but the literature gives them very little consideration.

2. Measures of High School Achievement.

In the present organization of the educational system, completion of high school is ordinarily a prerequisite for admission to college. For purposes of articulation, the high school curriculum is heavily weighted with subjects that prepare the individual for college. It is therefore reasonable to examine high school achievement in the hope that it may be indicative of future performance in college.

In a study of forty-six factors differentiating college freshmen having lowest and highest point-hour ratios, Carter and McGinnis¹⁴ found the following high school measures highly discriminatory: point-hour ratio, estimate of the principal, subjects failed, and mathematics courses taken.

Among early studies in this field was one by Clark¹⁵

¹⁴ Homer L.J. Carter and Dorothy J. McGinnis, ibid.

¹⁵ E.L. Clark, "Selection of Freshmen at Northwestern University College of Liberal Arts", in Educational Record, Vol. 8, No.2, issue of April 1927, p. 122-128.

concerning the selection of liberal arts freshmen at Northwestern University. By comparing quality of college work with the student's rank in high school, he obtained a correlation over .70; whereas in a comparison between psychological test scores and college work, he obtained only a coefficient of .60. Accordingly, he judged high school rank the better predictor.

In what is perhaps the most accurate scholastic prediction on record, Johnston¹⁶ used the combined average centile rank in high school and on the mental test, to which he compared college standing. He stated emphatically: "This individual rank in high school is the most valuable single measure of probable fitness for college work."¹⁷

Over the years, the value of the high school record does not appear to have diminished. Feder¹⁸, as long ago as 1935, and Stone¹⁹, as recently as 1954, both claimed it to be the most efficient single predictor of curricular

16 J.B. Johnston, op. cit., p. 20-23.

17 Id., ibid., p. 20

18 Daniel D. Feder, "An Evaluation of Some Problems in the Prediction of Achievement at the College Level", in Journal of Educational Psychology, Vol. 26, No.8, issue of November 1935, p. 597-603.

19 Joics B. Stone, "Differential Prediction of Academic Success at Brigham Young University", in Journal of Applied Psychology, Vol. 38, No.2, issue of April 1954, p. 109-110.

success in college. The superiority of high school marks over intelligence test scores has been demonstrated repeatedly; however, combining these measures does increase their predictive efficiency^{20,21}. Lauer and Evans²² examined the relative value of intelligence test score and high school average in English, mathematics, and history in predicting first-quarter grade averages for 492 Iowa State College freshmen. Their study revealed that standing in high school mathematics is a slightly better predictor than any other single subject, but inferior to the weighted composite high school average. They too found the intelligence test score inferior to the composite high school record.

There appears to be substantial accord among these findings, despite varying viewpoints. Jones and Laslett²³,

20 Jess H. Edds and W. Morrison McCall, "Predicting the Scholastic Success of College Freshmen", in Journal of Educational Research, Vol. 27, No.2, issue of October 1933, p. 127-130.

21 Norman Frederiksen and W.B. Schrader, "The A.C.E. Psychological Examination and High School Standing as Predictors of College Success", in Journal of Applied Psychology, Vol. 36, No.4, issue of August 1952, p. 261-265.

22 A.R. Lauer and J.E. Evans, "The Relative Predictive Value of Different High School Subjects on College Grades", in School and Society, Vol. 31, issue of February 1, 1930, p. 159-160.

23 George A.A. Jones and H.R. Laslett, "The Prediction of Scholastic Success in College", in Journal of Educational Research, Vol. 29, No.4, issue of December 1935, p. 266-271.

in concluding their study, sum up the situation in this way:

College scholastic success is dependent upon ability and upon industry. Prediction of college scholastic success must be based upon these factors if it is to be satisfactory. High standing in the intelligence test seems to be a prerequisite for succeeding in college, but does not guarantee success. The psychological test score is an index of ability. The high school academic average seems to be an index of habits of industry²⁴.

3. Non-intellective Traits.

From the developments sketched in the preceding sections, there appears to have developed a definite trend to use more and varied factors in attempting educational prognosis. As tests of general mental ability and the data of the high school record proved to be imperfect indices, investigators, in order to increase the accuracy of their predictions, focused their attention on the non-intellectual aspects of the student.

Freeman²⁵ attempted to identify factors which tended to reduce correlations between intelligence test ranks and college grades. As a result of conferences with students to explain discrepancies between the two, he found frequent

²⁴ Id., op. cit., p. 271.

²⁵ F.S. Freeman, "Elusive Factors Tending to Reduce Correlations between Intelligence Test Ranks and College Grades", in School and Society, Vol. 29, issue of June 15, 1929, p. 784-786.

reasons were improper motivation, extra-curricular activities, work for self-support, health, poor study habits, and absorption in other than scholastic interests. An investigation by Flemming²⁶ presented some evidence that traits of personality and emotionality, viz., introversion, steadiness, and consistence, in addition to intelligence, were related to college achievement.

Other characteristics apparently more closely concerned with academic success have also been evaluated. In a correlational study of intelligence, study methods, and college marks, H.D. Carter²⁷ concluded that aspects of study procedure contribute to the prediction of course grades. Votaw²⁸ presented strong evidence that the best equipment a freshman can bring to college is knowledge of the use of the library and study materials. Carter and McGinnis²⁹ also found to be important prognosticators

26 Edwin G. Flemming, "College Achievement, Intelligence, Personality, and Emotion", in Journal of Applied Psychology, Vol. 16, No.6, issue of December 1932, p. 668-674.

27 Harold D. Carter, "Correlations between Intelligence Tests, Study Methods Tests, and Marks in a College Course", in Journal of Psychology, Vol. 30, Second Half, issue of October 1950, p. 333-340.

28 David F. Votaw, "A Comparison of Test Scores of Entering College Freshmen as Instruments for Predicting Subsequent Scholarship", in Journal of Educational Research, Vol. 40, No.3, issue of November 1946, p. 215-218.

29 Homer L.J. Carter and Dorothy J. McGinnis, ibid.

certain basic skills (grammar, reading, and vocabulary) as well as the number of books and periodicals read; moreover, definite vocational choice was predictive of success.

To vocational choice there might be closely related the factors of motivation and interests. An inquiry by DiVesta and others³⁰ revealed that motivation pointed out important areas for predictive purposes in college. Phillips and Osborne³¹ reported no significant relationship between the Kuder Preference Record and weighted college grades. In a similar study at Wisconsin, the findings of Hake and Ruedisili³² indicate that interests, as measured by the Kuder, are a relatively minor factor in predicting college achievement. Used alone, interests would probably be of little value, but when used in a battery of aptitude and achievement tests, they might help to raise the degree of correlation.

30 Francis J. DiVesta, Asahel D. Woodruff, and John P. Hertel, "Motivation as a Predictor of College Success", in Educational and Psychological Measurement, Vol. 9, No.3, Part 1, issue of Autumn 1949, p. 339-348.

31 W.S. Phillips and R.T. Osborne, "A Note on the Relationship of the Kuder Preference Record Scales to College Marks, Scholastic Aptitude, and Other Variables", in Educational and Psychological Measurement, Vol. 9, No.3, Part 1, issue of Autumn 1949, p. 331-337.

32 Dorothy Terry Hake and C.H. Ruedisili, "Predicting Subject Grades of Liberal Arts Freshmen with the Kuder Preference Record", in Journal of Applied Psychology, Vol. 33, No.6, issue of December 1949, p. 553-558.

4. General Evaluation of Past Studies.

Perhaps the most fundamental criticism of many past studies would pertain to their criterion. This standard of comparison frequently is not described or defined adequately. In fact, the reasons underlying the choice of the criterion, and the principles governing its use, are sometimes not stated.

The foregoing studies mainly used academic success in college as their basis for evaluating the traits used for prediction. But a satisfactory measure of success or failure must be established: one which is valid, reliable, and useable. Often, the criterion chosen was class marks, which are generally of questionable reliability and validity, and contaminated with irrelevant factors³³. Of course, all measures derived from marks will be tainted by these serious weaknesses.

A number of the investigations used the results of group tests of general mental ability, commonly expressed as IQs. As Traxler³⁴ pointed out, there are limitations involved in the concept of the IQ itself; it is impossible to get the IQ of superior, mentally mature persons; the IQ

³³ J.P. Guilford, Fundamental Statistics in Psychology and Education, second edition, New York, McGraw-Hill, 1950, p. 352.

³⁴ Arthur E. Traxler, op. cit. p. 464

depends considerably on background and education. He also remarked that personality factors have a strong tendency to play havoc with predictions based on aptitude alone.

Having considered the past developments in educational prognosis at the college level, it is fitting to inquire as to the relation of these findings to the present study. This relationship can best be seen by considering the reasons for using the Otis in this survey.

The main reasons for employing the Otis tests of mental ability in this predictive study are the following. The Otis has been very widely used since it first appeared over thirty years ago. In many investigations of scholastic prognosis, the Otis has been found repeatedly to be of some value. Since the development of the French-language Otis, both tests have been administered extensively at the University of Ottawa, yet no study has been made of their utility as forecasters of academic achievement. Such an undertaking would seem particularly appropriate, not only because of the local guidance value of the findings, but especially because the Otis has been repeatedly termed a measure of scholastic aptitude. Finally, because of the special merits of the different approach to the problem, this study may be of some value.

CHAPTER II

THE CONDITIONS OF THE SURVEY

Since this study is directed towards the determination of the value of the Otis SA tests of mental ability in predicting the academic achievement of students at the University of Ottawa, a few preliminary considerations are in order: the measuring instrument, the situation at the University of Ottawa, the characteristics of the population sampled.

1. The Measuring Instrument.

Since their very first introduction over thirty years ago, the Otis Self-Administering Tests of Mental Ability¹ have been so widely used that their description here is unnecessary. Nevertheless, their recent critical appraisal by Super² could perhaps be consulted with profit.

The Otis has been labeled a measure of scholastic ability. The reason for this is that, in the standardization of his test, Otis selected items according to their

¹ Arthur S. Otis, Otis Self-Administering Tests of Mental Ability, Yonkers-on-Hudson, N.Y., World Book Co., 1922.

² Donald E. Super, Appraising Vocational Fitness, New York, Harper, 1949, p. 107-114.

power to discriminate between the younger and the older pupils in the same grade³. Thus the criterion was the rapidity of advancement in school.

The Otis SA tests were translated and adapted for use with the French-Canadian population in the year 1942. Les examens Otis-Ottawa d'habilete mentale⁴ consist of two examinations, the Examen superieur and the Examen intermediaire, which, while similar in form, differ in content and difficulty. The Examen intermediaire is designed for grades five through eight, whereas the Examen superieur is designed for high school students. Each examination contains two parallel forms which, differing only in content, may be used alternately for retest purposes.

The Otis-Ottawa is a self-administering group test composed of seventy-five items consisting of synonyms, antonyms, arithmetic problems, syllogisms, number and letter series, analogies, proverbs, and directions. Most items are of the multiple choice type and are presented in order of increasing difficulty. Answers are recorded by the testee in a single column beside the corresponding question on the

³ Arthur S. Otis, Manual of Directions and Key (Revised) for the Otis S.-A. Tests of Mental Ability, Yonkers-on-Hudson, N.Y., World Book Co., 1928, p. 3.

⁴ R.-H. Shevenell, O.M.I., Les examens Otis-Ottawa d'habilete mentale, Ottawa, Canada, University of Ottawa Press, 1942.

test booklet. Correction is done manually by means of a key. The score is the number of correct answers, provided that no points have been lost for failure to comply with instructions.

Because of the lack of norms for the Otis-Ottawa, scores on this test are interpreted tentatively according to the norms developed by Otis. It has been found experimentally that with these norms the Otis-Ottawa produced very satisfactory comparisons with the Otis on trial samples of the bilingual student population⁵. Use of the Otis Interpretation Chart provides a Binet Mental Age directly from the test score, or an Otis IQ from a knowledge of test score and chronological age.

Since the individual questions are not difficult and because the time limit is fixed at thirty minutes, the test is largely one of speed and attention in completing a verbal task. Consequently, such traits as knowledge of vocabulary, reading rate, span of attention, comprehension of instructions, speed and accuracy of performance, and information, in addition to native intelligence, are thought to influence the candidate's score. Because many of the aforementioned

5 R.-H. Shevenell, O.M.I., Manuel et normes (quatrieme edition, revue et corrige) of Les examens Otis-Ottawa d'habilete mentale, Ottawa, Canada, University of Ottawa Press, 1948, p. 30.

traits seem to influence success in school, the Otis-Ottawa has been called a measure of scholastic ability. The chief reason justifying this appellation is the criterion used for selecting items during standardization: rapidity of school advancement⁶.

The Otis-Ottawa tests are then similar to their English-language counterparts in regard to scope, content, form, administration, scoring and interpretation. The more important technical characteristics of reliability and validity are also in close agreement on both series of tests. The corrected reliability coefficients from parallel forms of the same test are generally in the low nineties, while validity presumably has been made comparable by use of the same method of standardization on both the Otis and the Otis-Ottawa. Moreover, the standard error of measurement of both tests is quite similar, being about three points whether in IQ or in raw score. It may then be concluded that the two tests are approximately equivalent. In virtue of this test equivalence, it follows that Otis and Otis-Ottawa test results are directly comparable.

The setting in which the tool just described was used, is a question of practical concern. For that reason, the existing situation at the University of Ottawa is discussed briefly in the following section.

⁶ Id., op. cit., p. 21-22.

2. The Situation at the University of Ottawa.

Like every institution, the University of Ottawa has a situation peculiar to itself. The characteristics of chief concern for the present study pertain to language, the high school, guidance, and the undergraduate faculties.

a) Language. -- The University is a bilingual institution having many subjects at all levels of instruction offered in both French and English, yet having whole sections of its curriculum given exclusively in one or the other language. Therefore, language conceivably may play an important role in achieving academic success at Ottawa. Consequently, in any attempt to study scholastic achievement there, some consideration must be given to the problem of language.

The difficulty is not as serious as it would appear. In reality the student chooses the course of studies which he can readily follow, for he realizes that his success may be jeopardized by a language handicap. Furthermore, the school administrative officers, by careful examination of the student's school records and background, attempt to restrict registration for any course to those who are adequately prepared to follow it profitably.

b) The High School. -- In conjunction with its undergraduate and graduate divisions, the University

operates an academic high school which offers French, English, and bilingual programs of instruction in grades nine through twelve. The University High School is largely a college preparatory school, not only because it restricts itself to a liberal curriculum but also because it attempts to select its students among those who can continue through college. In fact, it is estimated that about 85% of its graduates subsequently are admitted to the various faculties of the University.

The University High School is a private, Roman Catholic, boys' school for resident and non-resident pupils. The non-resident students come from the Ottawa-Hull area and live at home, whereas the resident pupils are mainly those who, coming from afar, must live in the University buildings. Practically all the students are Roman Catholic although boys of other faiths are readily admitted.

The student body comprises three language groups, French, English, and bilingual, with the bilingual group being the most numerous whereas the exclusively English-speaking students are least in numbers. The bilingual group is the most homogeneous since most of this group comes from the Ottawa bilingual separate school system. The French-language group consists of those pupils whose educational experience has been French and who generally come from Quebec or French-speaking districts of other

provinces. The most heterogeneous group is made up of the solely English-speaking Canadian and American pupils, in addition to students from other countries who have sufficient familiarity with English to enable them to follow the regular course of instruction.

Although pupils must pay tuition in order to attend the University, not all students are privately sponsored. Through an arrangement with the Ottawa Separate School Commission which lacks high school facilities, the University agrees to accept a number of grade nine and ten pupils from the Commission upon payment of a stipend. Although this is a voluntary agreement, nevertheless it tends to reduce the efficacy of the High School selection. This is especially apparent in grade eleven when many of the former Commission-subsidized students leave the University because further tuition there will be at their own expense.

c) Guidance. -- The question of continuing to college is one of the main problems facing the senior student at the University High School. The major problem is that of vocational choice, but, for most students, this is directly related to college entrance as a professional preparation.

The decision to go to college is far from simple. The complexity of the problem is obvious when one considers the number and variety of faculties, their course

requirements, the types of degrees conferred (pass, specialized, or honours degree), and the number of elective courses, to say nothing of the time required and the expense involved in pursuing higher education.

To assist the student in solving his educational, vocational, and personal problems, the University of Ottawa inaugurated a guidance program in its high school in 1943. According to this program, batteries of tests, inventories, questionnaires, and free compositions are given each class, each year in the fall, in order to obtain information about general and specific aptitudes, and personality. The exact composition of the battery is determined by the characteristics of the group as a whole: educational level, language, and the particular areas to be sounded.

A group test of mental ability is administered in nearly every grade: the Otis Intermediate is given in grade nine, whereas the various forms of the Otis Higher Examination are used in the other grades. Of course, in the French-speaking classes the corresponding Otis-Ottawa tests are used. Bilingual students are usually given their individual choice of writing the Otis or Otis-Ottawa test according to their language preference. In this way, each student accumulates, over the years, several independent estimates of his capacity, all his records being kept on file at the Guidance Centre for consultation purposes.

d) The undergraduate faculties. -- Numerous important changes have occurred among the undergraduate sections of the University in the period covered by this survey. One of these events has been the development of new and independent faculties.

With the emergence of separate faculties, new policies and practices have been adopted. Degree requirements are now on a credit basis whereas, previous to 1950, they were determined according to a prescribed system of compulsory subjects with very few electives. This new system has produced many changes in the curricula, especially as regards course requirements and the creation and choice of numerous options. As a further result, the degrees themselves have become more diversified and more specialized. Even the method of pupil evaluation has changed: in recent years the final mark has been a composite of the regular periodic tests and assignments, and the score on the final examination; formerly the subject mark was based on the results of the final examination alone. Moreover, the results in the various faculties are not comparable because of different marking systems and standards.

These modifications having been made gradually over the years, it is practically impossible to make allowance for these changes so as to permit comparison quantitatively. It follows that a qualitative method must be used.

After description of the general setting in which the present study was made, a topic of more immediate interest arises: the particular characteristics of the group which was surveyed.

3. The Population Sampled.

The distinctive features of the pupils whose psychometric results and college achievement were analyzed are outlined from two points of view. First, there are stated the reasons dictating the choice of the High School grade whose psychological test results were studied. Secondly, the period of time covered by the survey is treated in so far as it is related to the characteristics of the group.

a) The High School grade studied. -- Among the students most concerned about future college success are those who are about to graduate from high school. Therefore, to increase the practical educational guidance value of the project, only the aptitude scores of grade twelve students were used.

This was not, however, the only reason for choosing this particular class. The students at that stage are made very much aware of the impending vocational decision they must make; consequently they are more serious of purpose and better disposed to exert their most concentrated effort in taking the various tests which are administered to help

them solve this problem.

Furthermore, the fourth form pupils are more likely to be "test wise", thereby yielding a more nearly accurate measure of their ability. This is because relatively few students — usually less than 10% of the class — enter the University High School in the senior year. For that reason, practically all the members of that class have been subject to the testing program before, and have developed familiarity with test procedure.

It was not deemed advisable to use the psychological test results obtained at either a higher or a lower level, singly or in combination. A higher level would diminish the utility of the prediction: it would be redundant to wait until the pupil is actually in college to see if he can succeed there. This is precisely what the present study attempts to obviate. Although test findings in an earlier grade could be more useful, the test results would probably be less reliable; at an earlier stage the students might not be "test wise", and they might be lacking in motivation.

For these same reasons it would be unsuitable to combine test findings obtained over the whole four-year course. The resulting conglomerate would give a largely meaningless appraisal of individual aptitude, and would provide an inadequate basis for educational prognosis.

b) The period surveyed. -- The students who were surveyed in this project attended grade twelve at the University High School sometime during the school year from 1942-1943 to 1951-1952 inclusively. The progress of these same students was traced in the University faculties which they attended at any time during the academic years 1943-1944 through 1952-1953.

It must be noted that only a part of this period was during war time. Moreover, the Canadian military conscription policy was sufficiently lenient to enable the successful student to continue his education without hindrance. It does not appear that this war-time period exerted any widespread harmful influence upon the successful student population at that time. On the contrary, the possibility of conscription after academic failure may have acted as a powerful stimulus to improve pupil performance.

Yet, it must be said that some draft-age youths avoided conscription by attending college. Many of these young men, not having the requisite abilities for academic success, failed miserably. This excessive number of failures at the college level probably had little influence on the results of this survey since many of these students did not enter college from the University High School. Even had they come from this school, this fact would only have strengthened the findings of this inquiry.

In like manner, the post-war increase in college enrollment of veterans had little or no effect on this study because very few veterans, if any, had attended grade twelve at the University during the years specified.

* * *

By showing the equivalence between the Otis and the Otis-Ottawa tests of mental ability, and by sketching the traits of the student population under investigation, there has been indicated a possible solution to the problem of forecasting college achievement. The method would be this: to measure scholastic ability with the Otis or Otis-Ottawa in grade twelve; to evaluate the college results of these same students qualitatively; and, to compare both so as to obtain an index of relationship, and a method of prognosis.

This, in brief, is the rationale of the present survey. It is the function of the next chapter to describe the concrete application of this method.

CHAPTER III

THE DESIGN OF THE SURVEY

The method followed in this project was substantially to determine the subject's psychological test result in grade twelve at the University High School and to compare it to his achievement in the undergraduate faculties of this same institution. This procedure involved the collection of data, the selection of the Otis measure used, the scheme to appraise college performance, and finally the system of comparison employed to predict college achievement from the Otis test result. Each of these steps will be treated in turn to provide familiarity with the process involved in yielding the results obtained.

1. The Collection of Data.

The sources of the data of this research were the student academic records on file in the office of the University Registrar, and the psychological test results located in the Guidance Centre.

The annual class registers were consulted in order to identify those high school graduates who subsequently proceeded to any higher level at the University during the ten-year period being surveyed. The identity of these persons having been determined and duly noted, their college

record was examined and the pertinent data transcribed on an individual file card. Upon completion of this compilation, these cards were taken to the Guidance Centre where the file on each of these students was located. The individual's Otis or Otis-Ottawa results were noted with respect to the name of the test taken and its level and form, the class when administered, the pupil's chronological age, mental age, intelligence quotient, number of items passed, and number of items attempted.

Of the one thousand or more former High School students who went on to college during the specified period, the test results of approximately eight hundred were located. The reason for the lack of Otis data among the other two hundred could be their absence during testing, their arrival during the 'off-year' for testing, or their being pupils at the Juniorate where guidance tests were not administered.

2. The Otis Measure Used.

In the section describing the Otis and Otis-Ottawa tests of mental ability, it was pointed out that both tests exist in two levels, higher and intermediate, both of which series have different but comparable forms. Because it has been decided to use the test results of grade twelve pupils only, it is necessary to use exclusively the higher forms

of these examinations.

For this study, the Otis Self-Administering Tests of Mental Ability, Higher Form have been used indiscriminately with their French-language translation and adaptation, Les examens Otis-Ottawa d'habilete mentale, examen superieur. Such procedure seems permissible on account of the technical equivalence of the two tests. Because of their fundamental similarity and for the sake of simplicity in this discourse, henceforth the term 'Otis' will be used to refer to the higher forms of both the Otis SA and the Otis-Ottawa tests of mental ability.

The Otis yields several distinct measures of mental ability: the Otis IQ, the Index of Brightness, the percentile rank, and the Binet Mental Age, in addition to the raw score. In general practice, the Otis IQ, the Binet MA, and the raw score are used extensively, with the IQ being used much more frequently than the others. For all practical purposes, the use of the raw score or the Binet MA is identical because, as inspection of the Otis Interpretation Chart reveals, only one mental age corresponds to any given raw score. For example, the person obtaining a raw score of forty on the Higher Examination is given a Binet MA of 15 years 0 months regardless of his chronological age. On the other hand, the Otis IQ is determined by the testee's obtained score and his chronological age. Thus, if this

same score of forty points on the Higher Otis is obtained by subjects of, say, 14, 15, 16, 17, and 18 years of age, their Otis IQs will be 108, 104, 101, 99, and 98 respectively. It seems more valuable to know what an individual can accomplish in relation to his age than to know only his performance. As a consequence of this belief, IQs alone were used to evaluate the abilities measured by the Otis.

The test records of the thousand or more pupils who were followed during the investigation did not all include Otis IQs obtained in grade twelve. In fact, less than four hundred students were found who had been tested with the Higher Otis in fourth form and who had subsequent appropriate academic results on file. In the case of those very few pupils who were given two administrations of the Otis in their senior year in high school, the arithmetic mean of the two IQs was taken as the correct IQ. This procedure seems justifiable because it tends to compensate both for the "practice effect" on the second test, and for poor initial performance because the examinee was not "test wise". In no case did this practice change the IQ by more than five points, and usually the difference was about two or three points.

Concerning the administration of the tests used in this inquiry, it may be said that they were given in strict conformity to the directives contained in the manual of

instructions. This was mainly because the testing was done in practically ideal conditions, under the immediate supervision of experienced examiners, usually as a demonstration for psychometric technicians in training. The scoring and interpretation were equally carefully carried out, being checked and double-checked independently under the direction and supervision of the instructor in testing as a practical class exercise.

3. Evaluation of College Achievement.

Judging the calibre of a student's academic performance can be done in different ways. Perhaps the most objective method would be based upon the individual's scholastic record since this ultimately determines his school standing. The procedure employed in this inquiry was based upon the subject-matter marks contained in the official records of the University Registrar. However, the actual class marks themselves were not used directly as such. It was felt that because of the many changes inaugurated during the period in question, e.g. changes in curricula, modifications in subject-matter content, variations in marking systems, in addition to the generally conceded unreliability of school marks, it would be most inadvisable to use class marks as direct quantitative measures of pupil performance.

Instead, student success was appraised qualitatively. Inspection of the academic records readily revealed those students who had passed or failed any subject. Furthermore, the record of each year contained a valuable notation; when the Secretariate had typed the word "complete" it meant that the pupil had passed all his subjects and had completed sufficient subjects or credits to fulfill the course requirements of that year. The term "failed" was inscribed on the record when an excessive number of failures had been encountered, forcing the student to repeat the year. Otherwise, it was understood that the academic record was "incomplete", implying that the student had failed one or more subjects and had to repeat them in order to gain the required standing, and/or that one or more subjects were lacking and would have to be taken to satisfy the course requirements. However, such a student was nevertheless promoted, although he was required to make up all deficiencies before being permitted to be a candidate for a degree. Upon completion of the course, there was made an entry in the record stating the title of the degree and the date conferred.

Hence it appears that the annotated academic record could be used as a very suitable basis for evaluating the success of students. Since this very item serves to determine officially the individual's scholastic standing, it is

particularly fitting that it be used to determine the extent of his success in college for the purposes of this survey.

Since success is largely a matter of degree, it would be helpful to classify persons in several categories corresponding to varying levels of attainment. At the outset of this investigation, preliminary study of freshman probationary students who failed one, two, or three or more subjects indicated that on the basis of second year college achievement there was little difference between failing one or two subjects, whereas failing three or more subjects was much more important in discriminatory value. In accordance with these findings, this survey employs four distinct categories of scholastic proficiency:

- A - the student passed the year by failing no subject;
- B - passed conditionally, failing 1 or 2 subjects;
- C - passed conditionally, failing 3 or more subjects;
- D - the student failed the year.

Those pupils who had 'Complete' noted on their yearly record were placed in the 'A' group; those whose record was marked 'Failed' were entered in the 'D' class. The two remaining groups consist of students whose records were 'Incomplete' solely because of the unsatisfactory character of their year's work¹; these persons did

¹ Students not carrying a full study-load, being atypical, were not included in the survey.

inadequate work but were promoted conditionally. They were placed in a 'Conditional' category - B or C - in accordance with the number of subjects² they failed.

Use of these particular categories seems warranted because of their practical value. The high school senior thinking of going to college wants to know whether he will pass or fail. But he probably is far more interested in knowing the extent of his expected success or failure. Being forewarned, he can decide whether it is worth the risk to attempt such a course of action, or he can use this information as a spur to drive him on to greater effort in order to avoid failure.

It must be stressed that the academic records were analysed so as to yield the results obtained after the first full year in any given class. This result did not always correspond with the final outcome after one or more repetitions of that class. The reason for choosing the initial rather than the final outcome is one of practicality. The pupil contemplating the possibility of success in

² Subjects may be simple or composite. For example, History 10 is a simple subject having only one examination, whereas Mathematics 10 is a composite subject consisting of two separate units, one in Algebra and one in Geometry, the combination of both examination results yielding the mark in Mathematics 10. Throughout this project, the policy of the Secretariate was followed: the mark in the subject was the deciding factor and not the marks obtained in the component parts.

a given college class wishes to know what he can expect to do on the first attempt. Once informed of the probable results, he can decide what to do afterwards. It would be grossly unfair to tabulate results in terms of final or ultimate performance. In such a case, to state that an individual obtaining a given aptitude test score could expect to obtain, suppose, a baccalaureate implies nothing as to the time involved; it might be interpreted as being at the end of the normal four-year course, whereas in fact it should mean after, say, seven years involving considerable difficulty and repeated failures. But above all, this practice would be impossible of application in a limited survey such as this. How could one determine whether a specific student who failed had abandoned his academic pursuits permanently, or was merely recuperating temporarily to later renew the attempt?

This point brings up the question of how to deal with those pupils who, for any reason whatever, leave the course for the remainder of the school year. In this inquiry, such 'drop-outs' were merely left aside because they had no yearly record on which to base an appraisal of their scholastic ability. This procedure does not appear to have operated as a selective factor to affect the representative nature of the sample, since examination of the Otis IQs of 'drop-outs' did not reveal any consistent trend

for leaving college to be associated with any one level of aptitude.

Another point to be kept in mind is that academic results of all faculties were lumped together to obtain measures of yearly achievement. Thus, results of freshmen in Arts, Commerce, and Science, for example, were taken together without distinction to yield a composite measure of first year college performance. This procedure may be questionable and open to criticism because of alleged differences in difficulty of various programs of study. But in view of the many recent modifications in curricular organization where different programs of studies can closely approximate one another, further refinement in classification seemed unwarranted. More to the point, a comparison of grade twelve Otis IQs of University graduates in Arts, Science, Commerce, and Philosophy, indicated no significant difference in scholastic ability between students of these faculties. Furthermore, the method of comparison employed in the study necessitated large numbers in each category of achievement; manifold subdivision of groups would have prevented utilization of this method, and, because of the already broad basis of classification, probably would not have contributed appreciably to further differentiation.

Finally, the special treatment of the few Upper School results included should be described briefly.

Satisfactory completion of Upper School, Ontario Grade XIII, is equivalent to first year college standing. Since it is customary to take two years to complete Upper School because of the heavy work-load, in this survey the two-year period was considered as being of one year's duration. The number of subjects failed in the two years was averaged to approximate the equivalent one-year situation. For example, if a pupil failed two subjects in his first year and one in his second year of Upper School, he would be considered for practical purposes to have failed one and a half, i.e. two, subjects in the normal college course. In the case of those very few students who took Upper School in one year, the number of subjects failed was halved to give comparable freshman college performance.

4. The Method of Comparison.

Mention has already been made of the fact that the data under study are categorized qualitatively as regards academic success, and quantitatively with reference to aptitude test scores. The comparison of these variables has been made by two independent methods, the one method being the more usual procedure to appraise the relationship between aptitude and achievement, whereas the other is based on different considerations. Comparing the results of the latter procedure with those of the former more

standard approach permits the evaluation of the second method as a solution to this type of problem.

The first method consists in estimating the extent of relationship between aptitude and achievement by comparison of frequencies. It makes use of the Chi-Square technique and of the contingency coefficient.

The second method is based upon the solution of Guttman³ for predicting a qualitative attribute from a quantitative variate. This particular application, developed by Guilford⁴, employs a double classification made up of aptitude test scores distributed by frequency according to the category of academic success attained. Proportions of total frequencies at each level of aptitude are then cumulated by successive categories. To facilitate the interpretation of this tabulated data, graphs are drawn of the cumulated proportions in each category at every level of aptitude. The resulting curves indicate the proportions of individuals in (or the proportion of chances for being in) any given category of proficiency. Consequently, the

³ Louis Guttman, Supplementary Study B, p. 250-364, especially p. 271-272, in Paul Horst, The Prediction of Personal Adjustment, Bulletin No. 48, Social Science Research Council, N.Y., The Council, 1941, p. xii-455.

⁴ For a detailed example illustrating the use and interpretation of this method, see J.P. Guilford, Fundamental Statistics in Psychology and Education, 2d ed., N.Y., McGraw-Hill, 1950, p. 375-378.

interpretation of these graphs gives the extent of probability of the occurrence of any of the possible events.

Since this method is based on proportions of frequencies, it is of the utmost importance that the number of individuals be large. The overall size of the group surveyed and the numbers in each classification and level appear sufficient to allow use of this technique.

The advantages peculiar to this graphic technique of Guilford are due to the major differences from the more usual methods. For instance, with the usual procedures it is customary to test the significance of differences between groups: the greater the significance of differences between groups, the greater the possibility of determining critical scores, and the more meaningful their interpretation. But in this study, there was such extensive overlap between all categories in the distribution that use of such a method would have proved fruitless.⁵ Again, this great homogeneity among the different groups would have had a seriously depressive effect upon any correlational coefficient. This same effect would have likewise reduced the effectiveness of any regression equation for predictive purposes.

⁵ See Appendix 1 for a detailed demonstration of the serious overlapping observed in the various groups under study.

Guilford's method avoids some of the difficulties just mentioned and affords singular advantages. These advantages arise chiefly from the use of a multiple principle of classification. This method takes two points into consideration simultaneously: the test score the individual obtains, and the category of achievement in which he is found. This technique permits ready determination of critical scores by graphic inspection based on the principle of maximum likelihood. Moreover, besides classifying the individuals by category according to score, the graph readily points out the possibility of occurrence of other events and gives their probability in terms of proportions.

While the prediction of a variety of possible outcomes may seem a weakness, in this instance it is a very valuable realistic feature indicating the importance of individual differences in factors influencing pupil classification. Predictions of this nature are not infallible pronouncements of inevitable fact, but only estimates of future events based on probability determined by past occurrences.

After the description of the manner in which the survey was designed, there remains but to learn the results of the application of this method. These findings and observations are treated at length in the following chapter.

CHAPTER IV

OBSERVATIONS AND FINDINGS

The foregoing chapter has described the procedure followed in carrying out this survey. The purpose of the present chapter is to present the results of the study.

The raw data selected for use in this research may be found in condensed tabular form in Appendix 2. All the information about to be presented for discussion in this chapter has been derived from this material.

Even the most superficial examination of the data would make apparent two outstanding facts: the very broad dispersion of Otis IQs, and the extensive overlap of aptitude among persons of different degrees of scholastic achievement. Because of their close relationship, these two situations will be treated together, followed by an interpretation of their combined implications. Next, an evaluation of the overall relationship between aptitude test score and college success will be made. Finally, the results of the proposed graphic solution will be presented and discussed.

1. The Variability and Overlap of Talent.

It is generally held that as the performance of a task becomes more difficult, the less able competitors are

forced to withdraw while the more able candidates continue. Similarly, it might be thought that pupils of different measures of college success would have correspondingly different degrees of talent, success and talent being supposedly directly related to a high degree. According to this supposition, homogeneity would be characteristic of all individuals at any given level of performance. That this condition is not realized is apparent from an inspection of Table I showing the frequency distribution of Otis IQs according to category of success in the Freshman year.

The widespread range of aptitude is clearly indicated by the distributions in all categories of success. Nevertheless, there seems to be a tendency for each level of scholastic performance to center about an IQ commensurate with the degree of academic proficiency.

A similar situation was observed in examining the corresponding data of the remaining three years of college¹. The relatively small numbers found in the lower categories among upperclassmen, however, diminish somewhat the reliability of the findings. Nevertheless, inspection of these distributions reveals overlap among the different divisions of success as well as between the several college classes.

¹ These data have been relegated to Appendix 3 where they are tabulated.

Table I. - Frequency of Otis IQs Distributed by Category of Freshman College Achievement^a.

Grade 12 <u>Otis</u> IQ	Freshman College Achievement ^b			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
135 - 139		1		
130 - 134	2			
125 - 129	12	5		
120 - 124	15	12	5	1
115 - 119	10	26	5	4
110 - 114	15	30	11	5
105 - 109	23	23	19	8
100 - 104	6	31	14	14
95 - 99	10	15	4	8
90 - 94	2	9	10	7
85 - 89		3	2	
80 - 84	1	1		
Total Number	96	156	70	47
Mean <u>Otis</u> IQ	112.3	108.3	105.3	103.3
Standard Deviation	10.4	9.7	8.8	7.8

a Data pertains only to full-time students who followed the entire Freshman year in any faculty of the University of Ottawa between September 1943 and June 1953, and who had an Otis or Otis-Ottawa IQ obtained on the Higher Form while in Grade 12 at the University High School.

b College achievement is determined by the number of subjects failed according to the following system:

- A - passed the year by failing no subjects;
- B - passed conditionally, failing 1 or 2 subjects;
- C - passed conditionally, failing 3 or more subjects;
- D - failed the year.

The observed widespread variability in talent is not a haphazard phenomenon to be readily discounted. This conclusion is further substantiated by reference to the accompanying table on page 46 giving the Otis IQs obtained by college graduates at the University of Ottawa when they were Grade 12 pupils at the University High School.

Examination of Table II reveals the wide range of talent among college graduates: the Otis IQs range from the low 80s to the low 130s. There is an apparent clustering of ability between 105 and 115 of IQ. Although the bulk of the group is concentrated between the IQs of 100 and 120, there is approximately 30% of the group practically equally divided as to being above or below these latter limits. Perhaps the most amazing thing is the realization that more than half of these college graduates, when high school seniors, had Otis IQs which were below the 110 value usually regarded as being the minimum intelligence quotient predictive of the successful completion of college.

The existence of considerable dispersion of talent among college graduates strengthens the belief that great variability in aptitude is characteristic of all levels of college success.

Notice has already been taken of the occurrence of overlapping among the various groups of college students being studied. Some idea of the extent of this overlap may

Table II. - Frequency Distribution of Otis IQs
Obtained by University of Ottawa College Graduates^a.

Grade 12 <u>Otis</u> IQ	Frequency
130 - 134	1
125 - 129	10
120 - 124	14
115 - 119	18
110 - 114	33
105 - 109	37
100 - 104	24
95 - 99	15
90 - 94	8
85 - 89	2
80 - 84	<u>1</u>
Total Number	163
Mean <u>Otis</u> IQ	109.0
Standard Deviation	9.6

a Otis or Otis-Ottawa IQs obtained in Grade 12 of the University High School by students who later obtained the baccalaureate after completion of the regular intra-mural course in any faculty of the University of Ottawa between the school years 1943-1944 and 1952-1953 inclusively.

be gained from the statistics summarized in Table III which follows on page 48. It is observed that the means of adjacent categories do not differ considerably, nor do the standard deviations appear to vary appreciably from group to group.

The full meaning of these statistics can best be interpreted in the light of the tests of significance that were applied to them. The "t" test was used to appraise the differences between means, while Snedecor's F ratio served to evaluate the differences between standard deviations of the sample groups. Such information is presented in Tables IV and V.

These tables yield two principal findings. First, there are only two instances of a statistically significant difference in variability between groups of students in the same class even at the .10 probability level. The second observation is twofold: the only consistently significant differences in means are those between categories A and B at all levels; compared to other classes, the Freshman year shows by far the greatest incidence of significant differences among the means of its subgroups. Therefore, the Freshman year has, of all classes, the greatest discriminatory power for predictive purposes. Prediction for upper classes should be restricted mainly to differentiation between the A and B levels of success.

Table III. - Frequencies and Otis IQs Classified According to Category of Achievement by College Class^a.

College Class	Category of Achievement	Number of Students	Otis IQ in Grade 12	
			Mean	Sigma
<u>1st Year</u>				
	A	96	112.3	10.4
	B	156	108.3	9.7
	C	70	105.3	8.8
	D	47	103.3	7.8
	All Groups	369	108.1	10.0
<u>2nd Year</u>				
	A	135	110.7	9.9
	B	86	105.7	8.8
	C	16	108.6	9.3
	D	15	106.2	11.3
	All Groups	252	108.6	10.0
<u>3rd Year</u>				
	A	122	110.9	9.4
	B	55	104.5	10.6
	C	14	107.4	9.1
	D	13	105.8	8.5
	All Groups	204	108.6	9.7
<u>4th Year</u>				
	A	151	109.5	9.5
	B	19	103.3	8.2
	C	8	112.0	8.6
	D	-	-	-
	All Groups	178	108.9	9.6

^a This table has been compiled by condensing the data reported in Table I and in Appendix 3.

Table IV. - "t" Ratios Testing Differences Between Mean Otis IQs of Various Categories of College Achievement Arranged by Class^a.

College Class	Category of College Achievement			
		<u>B</u>	<u>C</u>	<u>D</u>
<u>1st Year</u>				
	A vs.	<u>3.02</u> ^b	<u>4.66</u>	<u>5.73</u>
	B "		2.27	<u>3.60</u>
	C "			1.28
<u>2nd Year</u>				
	A vs.	<u>3.94</u>	.82	1.43
	B "		1.12	.16
	C "			.62
<u>3rd Year</u>				
	A vs.	<u>3.83</u>	1.31	1.97
	B "		1.00	.46
	C "			.46
<u>4th Year</u>				
	A vs.	<u>2.98</u>	.75	-
	B "		2.31	-
	C "			-

a Evaluation based upon the data reported in Table III.

b Underlined "t" ratios are those found to be significant at the .01 level of probability.

Table V. - Variance Ratios Testing Differences Between Several Categories of College Achievement Arranged by Class^a.

College Class	Category of College Achievement			
		<u>B</u>	<u>C</u>	<u>D</u>
<u>1st Year</u>				
	A vs.	1.16	1.40	<u>1.76^b</u>
	B "		1.21	<u>1.52</u>
	C "			1.26
<u>2nd Year</u>				
	A vs.	1.26	1.07	1.38
	B "		1.18	1.74
	C "			1.48
<u>3rd Year</u>				
	A vs.	1.29	1.00	1.14
	B "		1.29	1.46
	C "			1.14
<u>4th Year</u>				
	A vs.	1.28	1.07	-
	B "		1.19	-
	C "			-

^a Evaluation based upon the data reported in Table III.

^b Underlined 'F' ratios are those found to be significant at the .10 level of probability.

Again from these findings, it follows that all the groups are approximately equally variable. Moreover, the great lack of statistically important differences in group means indicates that there is some similarity among means of different categories. These two inferences again reveal the spread and overlap in aptitude previously mentioned.

At this point it would be well to again refer to Appendix 1 to note the overlap in the Freshman distribution. If such extensive overlap is found in this, the most variant group, overlap in the other more homogeneous classes must be indeed enormous!

All the above observations have consequences of practical importance to this survey. The prominent spread and overlap in talent tend to preclude the use of any technique to determine critical scores to distinguish between groups. Nevertheless, the Freshman year in college is the most valuable for purposes of differential prediction. Of all categories of success, forecasting for divisions A and B in each class is most reliable.

The foregoing somewhat conflicting statements have probably occasioned some doubt as to the existence of any relationship between scholastic aptitude and academic achievement. Accordingly, attempts will now be centered upon the solution of this fundamental question.

2. The Relationship between Aptitude and Achievement.

The data of this survey are categorized qualitatively as regards academic success, and quantitatively with reference to aptitude test scores. It would appear, then, that the most suitable method for estimating the relationship between aptitude and achievement would involve the comparison of frequencies. For this purpose, the Chi-Square technique has been employed. Table VI lists in each cell the observed frequency and the expected frequency based upon the marginal totals. From these frequencies and their discrepancies have been derived the cell square contingencies and the resulting Chi-Square presented in Table VII on page 54.

Comparison of the obtained Chi-Square of 55.01 with the tabular value of 37.70 for a Chi-Square with fifteen degrees of freedom, shows the obtained value to be very significant even at the .001 level of probability. This indicates the overwhelming odds that the Freshman distribution differs markedly from the expected distribution based on the marginal totals of frequencies. Analysis of Table VII reveals that the most important contributions to Chi-Square are made by categories A and D and by IQs of 120-139 and 100-104. Discrimination being best in the extreme categories A and D, students with Otis IQs of 120

Table VI. - Observed and Expected Frequencies of College Freshmen Classified by Otis IQ and Category of Achievement^a.

<u>Otis</u> IQ in Grade 12	Category of College Achievement								Total	
	<u>A</u>		<u>B</u>		<u>C</u>		<u>D</u>			
	f_o	f_e	f_o	f_e	f_o	f_e	f_o	f_e	f_o	f_e
120-139	29	13.8	18	22.4	5	10.1	1	6.8	53	53.1
115-119	10	11.7	26	19.0	5	8.5	4	5.7	45	44.9
110-114	15	15.9	30	25.8	11	11.6	5	7.8	61	61.1
105-109	23	19.0	23	30.8	19	13.9	8	9.3	73	73.0
100-104	6	16.9	31	27.4	14	12.3	14	8.3	65	64.9
80-99	13	18.7	28	30.4	16	13.7	15	9.2	72	72.0
Total	96	96.0	156	155.8	70	70.1	47	47.1	369	369.0

a The data of this table has been obtained by regrouping the classes listed in Table I and computing the expected frequencies from the marginal totals.

Table VII. - Cell Square Contingencies for the Computation of Chi-Square for College Freshmen Classified by Otis IQ and Category of Achievement^a.

Grade 12 <u>Otis</u> IQ	Category of College Achievement				Total
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
120-139	16.74	.86	2.58	4.95	25.13
115-119	.25	2.58	1.44	.51	4.78
110-114	.05	.68	.03	1.00	1.76
105-109	.84	1.97	1.87	.18	4.86
100-104	7.02	.47	.23	4.78	12.50
80-99	1.74	.19	.39	3.66	5.98
Total	26.64	6.75	6.54	15.08	55.01

a The cell square contingencies have been calculated from the discrepancies between the observed and the expected frequencies reported in Table VI.

and above are most likely to pass all the subjects of the Freshman year, and least likely to fail their year. Pupils with Otis IQs between 100 and 104, on the other hand, are more likely to fail the Freshman year than to succeed completely. However, in view of the widespread overlap, it is evident that the association is not perfect.

The extent of the relationship between scholastic aptitude and academic achievement may be assessed by means of the coefficient of contingency. In this instance, the coefficient obtained from the 4x6 contingency table above, Table VII, was .36 which is significantly greater than zero. This value may be considered approximately equivalent to an "r" of the same magnitude. Consequently, it may be concluded that there is a definite but rather low correlation between aptitude test score and success in the college Freshman class. This correlation is roughly of the order usually found between aptitude tests and measures of achievement.

Curiosity may have been aroused concerning the relationship of these same characteristics in other college classes. Because the statistical tests reported in Section 1 of this chapter showed the Freshman year to be superior to other college classes in predictability, the contingency tables of the second, third, and fourth years have not been included here. Nevertheless, the contingency

tables of these upperclassmen were worked out and were found to corroborate the finding of superior Freshman predictability. The fourth-year distribution does not even approach statistical significance; the second-year and third-year distributions, however, are barely significant at the .01 probability level. In spite of the latter fact, there is the more pertinent observation that, in the second and third years, only the overall trend in association is meaningful, and that no specific category of success or level of aptitude is important in itself. This is equivalent to stating that forecasting college achievement based on aptitude test scores is increasingly difficult beyond the Freshman year in college.

The relationship between the variables having been determined, the possibility of prediction is immediately established. There remains but to study the actual prediction made.

3. A Graphic Approach to Prediction.

The superiority in predictability of the Freshman year over other college classes has been amply demonstrated. For that reason, this section will treat only the forecast made concerning Freshman achievement.

The substance of this section is made up of a table on which is based the graphic technique of prediction, and

a figure embodying the actual predictions. Although closely related, these topics have been divided into two separate articles.

a) The table. -- The proposed graphic solution requires the information contained in Table VIII on the following page. Because of the rather involved nature of the content of this table, its construction will be described in detail.

With reference to Table VIII, it should be noted that the total frequency of each IQ level is first given; then the categorized frequencies, cumulated horizontally, are tabulated for that same IQ level. An example will make this clear. Using the 110-114 IQ level for instance, it is found that 61 pupils obtain test scores in this IQ range. Of these students, 15 are in Category A, so this number is entered under f_A . Of the remaining 46 pupils in the original group, there are 30 B-students, 11 C-students, and 5 D-students. This latter information is not found explicitly in Table VIII. Instead, the 15 individuals in A and the 30 in B have been added together and considered to be in the combined categories of A and B, yielding a total of 45 which is listed under f_{AB} . Similarly, under the heading f_{ABC} is entered 56, corresponding to the number of persons found in categories A, B, and C together, i.e. the 45 people in A and B in addition to the 11 in C. The table

Table VIII. - Frequency Distributions, and Raw and Smoothed Proportions Cumulated by Successive Upper Categories of Freshman College Achievement Classified According to Otis IQ^a.

Otis IQ in Grade 12	Total Frequency	Category of Freshman College Achievement								
		<u>A</u>			<u>A-B</u>			<u>A-B-C</u>		
		f_A	P_A	sp_A	f_{AB}	P_{AB}	sp_{AB}	f_{ABC}	P_{ABC}	sp_{ABC}
135-139	1	-	(.00)	-	1	(1.00)	-	1	(1.00)	-
130-134	2	2	(1.00)	-	2	(1.00)	-	2	(1.00)	-
125-129	17	12	.71	.62	17	1.00	.94	17	1.00	.99
120-124	33	15	.45	.46	27	.82	.86	32	.97	.96
115-119	45	10	.22	.29	36	.80	.79	41	.91	.93
110-114	61	15	.25	.26	45	.74	.73	56	.92	.91
105-109	73	23	.32	.24	46	.63	.64	65	.89	.87
100-104	65	6	.09	.19	37	.57	.61	51	.78	.81
95-99	37	10	.27	.17	25	.67	.58	29	.78	.77
90-94	28	2	.07	.14	11	.39	.48	21	.75	.76
85-89	5	-	(.00)	-	3	(.60)	-	5	(1.00)	-
80-84	2	1	(.50)	-	2	(1.00)	-	2	(1.00)	-
Total	369	96			252			322		

a The data of this table has been obtained from the frequency distributions contained in Table I. The notations used are as follows:

f_A : frequency of students in 'A' group.

P_A : proportion of students at each IQ level who were in 'A' group.

Proportions in parentheses are ignored, being from very small samples.

sp_A : smoothed proportion of students at each IQ level who were in 'A' group.
Smoothing formula used was: $\frac{1}{4}(p_1 + 2p_0 + p_{-1})$.

f_{AB} : frequency of students in the 'A' and 'B' groups combined.

contains no direct reference to the frequencies found in group D, such information being obtained by subtraction of the frequency in the combined categories of A, B, and C, from the total frequency at that same aptitude test score level.

The proportions mentioned in Table VIII also require clarification since their derivation differs from the usual procedure; here the proportions are cumulated horizontally. The derivation of these values will be illustrated by the continued use of the example of the preceding paragraph. The proportions listed under p_A , p_{AB} , and p_{ABC} are merely the frequencies, tabulated under f_A , f_{AB} , and f_{ABC} respectively, which have been converted to proportions calculated on the basis of the total frequency at that IQ level. Thus, at the 110-114 level, the 15 A-pupils constitute a proportion of .25 (rounded to two decimals) of all the 61 students in this IQ range, so .25 is entered under p_A . Likewise, the 45 persons comprising the combined AB class being 45/61, or .74, of those pupils in this range of aptitude, .74 is entered under p_{AB} . The proportion .92 is found below p_{ABC} because the 56 persons included in the A, B, and C categories together constitute a proportion of .92 of the 61 students with IQs between 110 and 114 inclusively.

The proportions obtained indicate the proportion of persons, of a given score range, who attain the degree of success of the specified categories. Using still the same example as above, it is reported in the table that the proportions in categories A, AB, and ABC are .25, .74, and .92 respectively. This would be interpreted as follows. Of the 61 persons having IQs between 110 and 114, there is a proportion of .25 of A-students. Since .74 of the group consists of both A- and B-pupils, and since .25 comprises the A category, consequently a proportion of .49, the difference between p_A and p_{AB} , is found in the B division. As C-pupils, there would be .18 of the group: p_{ABC} less p_{AB} . The remaining proportion, 1.00 less p_{ABC} , or .08 of the students would fall in the D group. This exact interpretation may also be used to yield the proportion of chances of any person in the given IQ range to attain the various levels of success.

In the column of proportions in each category, there are a few entries, at the extremes of the distribution, which are enclosed in parentheses. These values were ignored, being very uncertain owing to the extremely small samples from which they were computed. A total frequency of ten was arbitrarily set as a minimum qualification for considering a sample to be of sufficient size to provide reasonably stable proportions. Rejecting frequencies below

ten results in the elimination of both tails of the distribution. This is not a serious loss, however, since pupils rejected on this basis, those with IQs below 90 or above 129, make up less than 3% of the total sample.

Each of the various categories of the table is seen to contain a column of smoothed proportions. These values have been obtained by calculation directly from the obtained proportions in the corresponding categories. The smoothed proportion for any class is the sum of twice the proportion in that class, plus the proportion in the preceding class and the proportion in the class immediately following, divided by their number. For example, in the A category there is a proportion of .25 in class 110-114, .22 in the class above, and .32 in that below. Thus, .22, plus .25 twice, plus .32 total 1.04 which, when divided by the number of proportions added, four, gives a smoothed proportion of .26 which is entered in the sp_A column opposite 110-114. In the case of the first and last values found in the smoothed proportion column of each category, the procedure was modified. For instance in category A, the proportion of .71 is found in class 125-129, and the class below contains .45 while the class above is disregarded. Then the smoothed proportion will be .45 plus .71 twice, divided by three, or .62 as the final value.

Smoothing was employed to remove the sometimes excessive irregularities which, judged by the distribution trend, seemed to result from sampling fluctuations. In the light of the wide variability in test scores, the explanation appears reasonable and the procedure justifiable. Moreover, the process seems acceptable on the empirical grounds that it preserves the group trend and does not alter individual proportions appreciably.

Introduction and discussion of the foregoing table was but a preliminary to the presentation of the graphic method of prediction. Hence, it is appropriate to proceed to the proposed solution itself which is found summarized in Figure 1 on page 63.

b) The figure. -- Figure 1 is the graphic incorporation of the compendious material of Table VIII. This being so, many of the remarks made concerning the table will apply directly to the figure.

The curves of both the observed proportions and of the smoothed proportions in each division have been included, the thin line being the actual proportions and the thick line the smoothed proportions. It is apparent that the latter curve conforms to the trend of the actual distribution while avoiding the more atypical values.

An example will illustrate the mode of interpretation as well as the difference between the curves. Take an

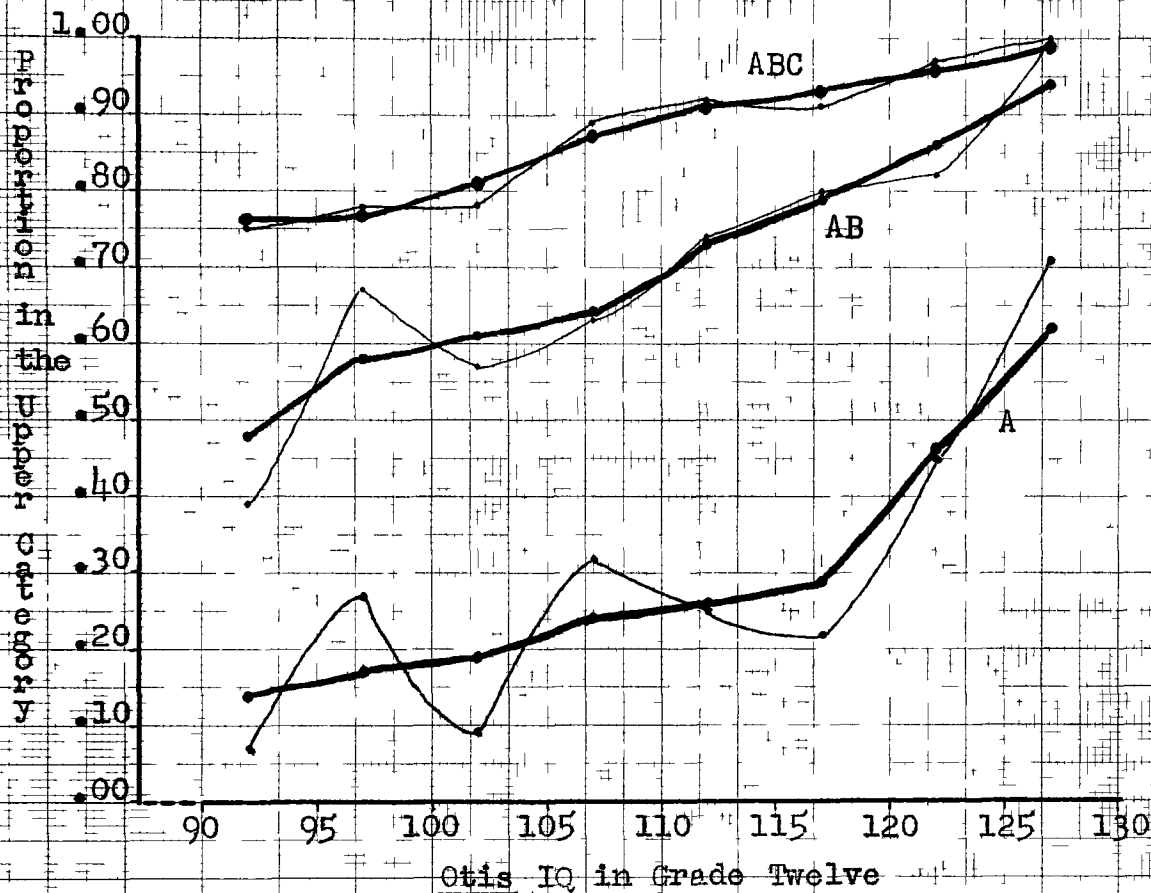


Figure 1. - Raw and Smoothed Proportions Cumulated by Successive Upper Categories of Freshman College Achievement Classified According to Otis IQ.

a Data obtained from the information listed in Table VIII on page 58. The notations used in the figure are the following:

- A : proportion of students at each IQ level who are in the 'A' group;
- AB : proportion of students at each IQ level who are in the 'A' and 'B' groups combined;
- ABC : proportion of students at each IQ level in the 'A', 'B', and 'C' groups combined.

The thin line is the graph of the obtained proportions, whereas the thick line represents the smoothed values of these proportions.

IQ of 95 for instance, using first the observed proportions curve, then that of the smoothed proportions. Mounting the graph vertically above a score of 95, the ordinate meets curve A at .20, curve AB at about .61, and curve ABC at .77. This indicates that the Freshman candidate with an IQ of 95 in grade twelve would have the following number of chances in 100 to attain the various levels of academic achievement: 20 chances for A, 61 for A and B combined, 77 for A, B, and C together, and therefore 41 chances for B, 16 for C, and 23 for D. The curves of smoothed proportions for IQ 95 give the following points of intersection with the vertical: A at .16, AB at .54, and ABC at about .77. These values correspond to the following percentage of chances for obtaining the various levels of success: 16 for A, 54 for A and B combined, 77 for A, B, and C together, and therefore 38 for B, 23 for C, and 23 for D. In the case of the IQ of 95, the discrepancies in values for the two series of curves are not considerable, excepting for categories A and C. The smoothed curves seem to be more in accord with normal expectations, and are probably more reliable since they avoid the sometimes erratic fluctuations of the obtained distributions.

Again it must be pointed out that the complete curves in each category are not traced. The less reliable extremities of each curve have been discarded, leaving only

the central portions of the distribution for which the prediction is far less hazardous.

It appears legitimate to represent the data of Table VIII by means of curves. The tabular data consist of frequencies and proportions presented in such a way as to show what is typical of each group, the point of reference being the mid-point of the class, and each class being considered as a separate, distinct entity. But essentially this does not conform to the facts. In reality, the distribution of test scores is a continuum, with someone obtaining practically every score or point on the scale. Thus, values should be represented as continuous and not discrete. Lines fulfill this function. Graphs, therefore, by tracing the gradual change from point to point are superior to tables in that respect.

This graphic predictive technique has numerous advantages. Excepting the provision of an index summarizing the relationship between aptitude and achievement, this method offers practically every information supplied by the other techniques hitherto employed in this report. The graphs readily reveal the fact of variability, range, and overlap of talent in each college class. A comparison of the graphs of the several college classes would show the difference in homogeneity among the various college years, with the attendant superiority in predictability of the

Freshman year over all the others. The graphs would also point out that the greatest differentiation at all levels is between the A and B categories of achievement.

Perhaps the most outstanding feature of this method lies in the fact that this graphic approach to prediction is far less categorical than the more customary techniques. It does not pigeon-hole people: it does not rigidly restrict the forecast to one dogmatically asserted outcome determined solely by the main tendency of the group as a whole without due allowance for the distinctiveness of the individual. The method offers, instead of prescription, a statement of probabilities of various outcomes which allow for individual differences, thereby enabling treatment of people as persons and not as lifeless statistics.

CONCLUSIONS

The data analyzed in the course of this survey have revealed information concerning academic prediction based on scholastic aptitude test scores. A summary of the most general conclusions warranted by these findings follows.

College success at the University of Ottawa can be predicted from a knowledge of the Otis IQ obtained in grade twelve. Nevertheless, because the relationship between aptitude and achievement is rather low, accurate forecasting is very difficult.

The predictability of scholastic performance is not identical in the several college years. The freshman year greatly surpasses the succeeding years in ease and worth of prediction.

All degrees of success are not equally predictable for every class. In all classes there is the greatest differentiation between those students who pass their year completely and pupils who fail one or two subjects. The prognosis for achievement in other than these two categories is of very limited value in the sophomore year and especially in the junior and senior years of college.

The setting of critical scores to fix the limits determining the different degrees of success is not feasible on account of the great variability and overlap in test scores.

Incidentally, the graphic technique employed has been shown to be a valuable, simple method well-suited to the study of problems of this nature. The predictions drawn by use of this method are realistic in that they make ample provision for the consideration of individual differences.

In summary, it can be concluded that Otis test scores, like most single predictors of academic achievement, tend to be inadequate when used alone. Therefore, it is suggested that they be combined with other proven and valid instruments, such as measures of high school achievement and non-intellective traits, thereby increasing their predictive efficiency,

BIBLIOGRAPHY

Crawford, Albert B. and Paul S. Burnham, Forecasting College Achievement, Part I, General Considerations in the Measurement of Academic Promise, New Haven, Yale University Press, 1946, xxi-291 p.

Contains basic definitions, assumptions, objectives, and rationale of academic prediction in college.

Donahue, Wilma T., Clyde H. Coombs, and Robert M.W. Travers, Editors, The Measurement of Student Adjustment and Achievement, Ann Arbor, University of Michigan Press, 1949, 256 p.

Consists of topics pertaining to measurement, achievement, adjustment, and academic prediction, written by authorities in each field. The section by Travers, "Significant Research on the Prediction of Academic Success", p. 147-177, contained an especially good, brief summary of the more important recent studies, and an excellent bibliography.

Garrett, H.F., "Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Science and Teachers Colleges", in the Journal of Experimental Education, Vol. 18, issue of December 1949, p. 91-138.

An excellent bibliography and a summary of recent research.

Guilford, J.P., Fundamental Statistics in Psychology and Education, 2nd ed., New York, McGraw-Hill, 1950, xiii-633 p.

In the section dealing with "Predicting Attributes from Measurements", in Chapter 14, Guilford describes on pages 375-378 the graphic technique used in this study.

Horst, Paul, The Prediction of Personal Adjustment, Bulletin No. 48, Social Science Research Council, New York, The Council, 1941, xii-455 p.

A sound comprehensive treatment of the rationale of prediction. Contains many cross-references to statistical topics and methods.

Appended to this treatise is the "Supplementary Study B", p. 250-364, by Louis Guttman, giving the logic underlying many statistical principles of prediction, among which is found on p. 271-272 that underlying the graphic method of Guilford.

Hovland, C.I. and E.F. Wonderlic, "Critical Analysis of the Otis Self-Administering Test of Mental Ability - Higher Form", in the Journal of Applied Psychology, Vol. 23, issue of June 1939, p. 386-387.

Concerned with item difficulty and arrangement, the article contains a very good bibliography related to the technical aspects of the Otis.

Otis, Arthur S., Manual of Directions and Key (Revised) for the Otis S.-A. Tests of Mental Ability, Yonkers-on-Hudson, N.Y., World Book Co., 1928, 12 p.
Useful particularly on account of the descriptive definition of terms, administrative procedure, and interpretation of results, the manual also treats of standardization, validity, and reliability.

Shevenell, R.-H., Manuel et normes (quatrieme edition, revue et corrigee) of Les examens Otis-Ottawa d'habilete mentale, Ottawa, Canada, University of Ottawa Press, 1948, 40 p.

Complete detailed manual including, besides the instructions for administration, scoring, and interpretation of test results, a lengthy treatment of the psychometric characteristics of the test and a discussion of concepts involved.

Stuit, Dewey B., et al., Predicting Success in Professional Schools, Washington, American Council on Education, 1949, xii-187 p.

A survey of predictive studies in professional college faculties. The first chapter was useful for its treatment of general considerations in prediction, and especially for its discussion of the limitations of past studies.

Traxler, Arthur E., "Reliability, Constancy, and Validity of the Otis IQ", in the Journal of Applied Psychology, Vol. 18, issue of April 1934, p. 241-251.

A large-scale longitudinal cross-validation of the Otis S-A Higher Form at the University of Chicago High School confirming the results of Otis.

APPENDIX I

OVERLAP IN FRESHMAN COLLEGE ACHIEVEMENT

There is reported on page 47 and in Table IV a number of statistically significant differences between the mean Otis IQs of adjacent categories of Freshman achievement. Lest these measures be interpreted immediately as being indicative of great divergence between these means, a simple procedure¹ will be utilized to ascertain the overlap between the various categories.

The method uses the mean and standard deviation of one sample as statistics, and treats the means of the other samples as scores in this one distribution. Assuming the normality of distribution of every sample under consideration, each mean is converted to a standard score in the reference sample. Since these become normal curve functions, the proportion of surface between the mean and the score in question can be read directly from the normal probability table. This value then gives, by subtraction from .5000, the proportion in one group above or below the mean of the other as the case may be.

This procedure will now be applied to the data of the Freshman year found in Table I. For ready reference,

¹ The procedure about to be described is found in: Edward A. Lincoln, "The Insignificance of Significant Differences", in Journal of Experimental Education, Vol. 2, No.3, issue of March 1934, p. 288-290.

this information is listed here:

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Mean	112.3	108.3	105.3	103.3
Standard Deviation	10.4	9.7	8.8	7.8

1. Using group A as point of reference:

Group A versus: B $z = \frac{108.3 - 112.3}{10.4} = -.38$

14.8% of surface is between M and z.
35.2% of A are below the mean of B.

C $z = \frac{105.3 - 112.3}{10.4} = - .67$

24.9% of surface is between M and z.
25.1% of A are below the mean of C.

D $z = \frac{103.3 - 112.3}{10.4} = -.86$

30.5% of surface is between M and z.
19.5% of A are below the mean of D.

2. Using group B as point of reference:

Group B versus: A $z = \frac{112.3 - 108.3}{9.7} = .41$

15.9% of surface is between M and z.
34.1% of B are above the mean of A.

C $z = \frac{105.3 - 108.3}{9.7} = -.31$

12.2% of surface is between M and z.
37.8% of B are below the mean of C.

D $z = \frac{103.3 - 108.3}{9.7} = -.52$

19.8% of surface is between M and z.
30.2% of B are below the mean of D.

3. Using group C as point of reference:

Group C versus: A $z = \frac{112.3 - 105.3}{8.8} = .80$

28.8% of surface is between M and z.
21.2% of C are above the mean of A.

B $z = \frac{108.3 - 105.3}{8.8} = .34$

13.3% of surface is between M and z.
36.7% of C are above the mean of B.

D $z = \frac{103.3 - 105.3}{8.8} = -.23$

9.1% of surface is between M and z.
40.9% of C are below the mean of D.

4. Using group D as point of reference:

Group D versus: A $z = \frac{112.3 - 103.3}{7.8} = 1.15$

37.5% of surface is between M and z.
12.5% of D are above the mean of A.

B $z = \frac{108.3 - 103.3}{7.8} = .64$

23.9% of surface is between M and z.
26.1% of D are above the mean of B.

C $z = \frac{105.3 - 103.3}{7.8} = .26$

10.3% of surface is between M and z.
39.7% of D are above the mean of C.

The assumption of normality was checked by several independent methods: Chi-Square, significance of measures of skewness and kurtosis, and comparison of frequencies, actual and theoretical, in overlap outlined above. In all

methods, there was found only a slight departure from the normal curve, insufficient for rejection of the hypothesis of normality. It follows then that there is very extensive overlapping among all the categories of Freshman college achievement.

APPENDIX 2

RAW DATA OF THE SURVEY

The present survey is an attempt at prediction of college achievement from a knowledge of scholastic aptitude test scores obtained in high school. The actual design of the survey has been fully described in Chapter III. The purpose of this appendix is to supply the raw material from which have been compiled the tables presented in this study. This information is contained in Table IX on the following page.

It must be noted that the data included in Table IX pertain only to those students who were in any class in any faculty of the University of Ottawa between September 1943 and June 1953, and who had a record of an Otis or Otis-Ottawa IQ obtained on the Higher Form while in grade 12 at the University High School.

Since it was decided to categorize academic achievement according to the number of subjects failed, this same principle of classification will prevail here. However, the notation used in Table IX should be explained since it differs from that used in the text of the thesis. Only the results of each full year are listed using this code:

- P - passed the year by failing no subject;
- F - failed the year;
- S - special course (partial load, extra-mural, etc.)
the results of which were disregarded;
- 1,2,... passed conditionally, the Arabic numeral
indicating the number of subjects failed.

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class.

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
124	1	P	1		
115	F	F			
99	2	P	P	P	BA, BPh
115	F	S			
116	P	1			
112	2				
126	P				
109	1	P	P	P	BSc
110	3				
113	2	F			
111	1	P			
97	2	1	P	P	BSc
111	2	P	P	P	BSc
94	F				
102	1				
111	1	2	P	P	BA, BSc
128	2	P	P		
100	1	P	1	1	BA
114	2				
108	2	2	F	3	BA
126	P				
87	2	2	1		
93	3	F	S	S	BA
97	F				
110	2				
111	P	P	P	P	BA, BPh
91	2				
105	1	P	1	P	BCom
104	3				
124	P	P	P	P	BA
100	F				
109	1				
118	1	P	1	P	BSc
91	1	P	F	S	
98	2	P			
122	3				
124	P	P	P	P	BSc
122	P	P			
109	P				
81	1	F	1	2	BA

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
101	2	P	P	P	BA, BPh
118	P	P			
107	F				
102	1	P	2	P	BCom
114	2	P	P	P	BCom
115	2				
122	2	3	5	3	
107	2	1	F	P	BA
114	F				
103	1	2			
100	P	P	P	P	BCom
104	F	P	2	P	BA
110	P	2	5	2	BA
114	S	P	2	2	
110	3				
98	F				
101	3	1	P	P	BA
115	2	1			
108	F	2	F		
114	2	4	5	4	
115	P	P	P	P	BSc
122	3				
106	F				
104	2	P	P	1	BA
112	P	P	P	P	BA
122	2				
125	P	P	1	P	BCom
108	3	1	P	P	BA
98	1	2	2	P	BA
101	2	2	F		
124	4	F			
122	2	3			
129	P	P	P	P	BA, BPh
128	2	P	P	P	BA
112	P	1	P	P	BA, BPh
95	F				
110	3				
110	2	1	1	P	BA
108	2	2	P	P	BSc
113	2	P	P	S	
126	2	2	F		

Table IX. - OTis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
129	P	P	P	P	BA, BPh
104	F	1	P	P	BA
124	P	P	P	P	BA, BPh
103	2	P	P	P	BA, BPh
100	2				
107	P	P	P	P	BSc
93	F				
120	P	P	P	P	BA
128	P				
100	1	P	P	P	BSc
97	2	2	1	1	BA
117	2				
93	2	2			
111	3	2	1	1	BA
106	1	1	P	1	BA
109	P	1	P	P	BA
114	1	3	1	P	BCom
108	P				
91	3				
123	F	2	S	S	BA
100	4	1	F		
106	P	P	2	3	
124	P	P	P	P	BA
119	P	P	P	P	BSc
103	P	P	P	P	BCom
118	3	3			
122	3				
119	2	1	P	P	BA
98	4				
107	2	P	P	P	BA, BPh
100	3				
108	3	4	4		
130	P				
109	3	2			
114	2	P	P	P	BA, BPh
117	S	P	P	P	BA
105	3	P	1	P	BA
110	3	1	P	P	BA
106	3	1			
99	2	1	S	P	BA
95	3	1	2	P	BA

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
99	P	P	P	P	BA
102	2				
104	2	P	P	P	BA,BPh
93	4				
102	2	1	P	P	BA,BPh
110	3	1	1	P	BA
91	4				
92	3				
124	P				
113	3	F	S	S	BA
95	P	P	2	2	
108	1	P	1	P	BCom
106	2				
119	P				
120	P	P	P	P	BSc
88	3				
94	P	P	P	P	BSc
102	3	2	1	P	
100	P				
116	1				
104	1				
119	2	P	P	P	BA
94	1	1	P	P	BA,BSc
95	P	P	P	P	BA,BPh
118	1	P	P	P	BA
97	2				
119	2	P	P	P	BA
120	2	1	P	P	BA,BPh
107	P	1	P	P	BA,BPh
100	1	2			
98	2	P	4	1	
128	P	P	P	P	BA
109	2	F			
117	2				
115	2	P	P	P	BA,BPh
88	1	2	1	P	BA,BPh
109	P	1	P	P	BA
103	2	P	P	P	BA
108	P	P	P	P	BA
106	4				
104	F				

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
102	3				
119	F	1	P	P	BA
113	P	P	P	P	BA
112	2	F	P	1	
107	3	2	P		
111	P	P	P	P	BCom
100	F				
113	3				
105	P	P	P	P	BSc
106	P	P	1	P	BA
106	3	F			
107	3	P	F	P	BA
95	2	P	5	S	BA
89	1	3	1		
109	3				
104	1				
117	2	P	3	P	BA
103	2				
107	1	2	1		
92	1	P	1	P	BA
119	P	P	P	P	BCom
109	3	3	F		
107	F				
98	1	1	P	P	BA
101	2	P	P	S	BA
109	2	P			
120	1	P	P	P	BCom
116	P	P			
94	3	2	2	1	BA
92	1	2	2	2	BSc
112	P	P	P	P	BA
108	2	1	3	5	BA, BPh
113	F				
122	P	P	P	P	BA
124	P	P	P	P	BA, BPh
97	3				
95	P				
111	1				
117	1				
105	F				
103	2	1	P	P	BA

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
101	2	1			
114	F	3	2	S	
112	2	1	P	P	BA
116	3	P	P	P	BA
106	2	1	3	1	
109	P	P	P	P	BA, BCom
106	1	3	2	P	BA
109	P	P	2	P	BA
99	2	P	P	P	BA
128	1	P	S	S	BA
119	P	P			
117	P	1	P	P	BA, BCom
105	P	P	P	P	BCom
105	3	P	2	2	BCom
113	1	P	P	P	BA
108	1	3	1	P	BA
124	P	P	P	P	BA, BPh
99	S	1	3	P	BA
103	P	P	P	P	BA
108	3	2	P	P	BA
103	4	1	P	P	BA, BSc
104	4				
108	3	2	1	P	BA
105	2	2			
97	P	P	S	S	BA
103	2	P			
108	1	1	P	P	BSc
120	1	2	7	4	
114	P				
100	2				
103	1	F			
98	F				
118	1				
110	1	P	1	P	BA, BPh
117	2	P	1		
115	4	3			
83	P	P			
108	P	1	P	P	BCom
112	2				
90	F				
120	2				

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
94	F				
108	3				
112	P	1	2	P	BCom
108	P	P	P	P	BCom
128	P	P	P	P	BSc
99	P	P	1	P	BA
115	2				
104	3	1			
123	P	P	P	P	BA
99	2	P	P	P	BA
110	F				
113	F				
108	F				
96	P	P	P	P	BA
130	P	P	P	P	BA
112	S	1	1		
113	2	P	P	P	BA, BPh
115	1	2	P		
94	2	1	1	P	BA, BPh
101	F				
108	4	1	P	P	BA
92	1	F			
96	P				
107	3				
115	1				
123	3				
107	F				
113	S	P	P	P	BA
95	P	P			
115	2	F			
114	P	P	P	P	BSc
93	F	F			
95	P	1	1	3	BA, BSc
100	2	P	P	P	BA
102	2	4	2	P	BA
108	1	P	P	1	BA
122	2				
123	P	P	P	P	BA
106	3	P			
111	P	P	2	P	BCom
107	P	P	P	P	BA, BSc

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
109	P	1	P	P	BA
98	F				
110	P	1	P	P	BCom
97	2	P	P	P	BA
116	F				
119	2	P	1	P	BCom
104	2	1			
98	S	1			
111	1	P	P	P	BA, BPh
103	2	1	1	P	BCom
106	2	P	P	P	BA
92	3	3	P	P	BA
115	5	F			
105	P				
99	F				
115	2	P	P	P	BA
110	2	P	P	P	BA
100	3	1	1	P	BA
121	2	P	S	P	BA
113	7				
103	1	S	1	S	
114	P	P	P	P	BA, BPh
119	1	P			
116	2				
138	1				
117	2	P	P	P	BA
105	5				
113	2				
128	P	P	P	P	BA, BPh
103	2	2			
114	3	F			
90	3	1	3	P	BA
92	P	2	F		
109	P				
102	3	P	2	P	BA
125	1	1	P	P	BA
121	P	P			
97	1				
103	2	P	P	P	BA
99	F				
92	1	1	2	S	BA

Table IX. - Otis IQ in Grade 12 and Subsequent Academic Achievement by College Class. (Continued)

Grade 12 Otis IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
114	2				
110	2	4	5		
109	F				
114	1	S	F		
110	P	1	P	P	BA
107	P	P	2	1	BCom
97	3	1	P	P	BSc
105	P	P	1	2	
110	1	P	P	P	BA
121	P	P			
111	P	P			
102	F	3	F		
121	1				
116	3				
111	3	2	P	P	
110	1	P	P	P	BCom
92	3				
118	P	P	P		
103	F				
105	2				
115	2				
103	F				
107	1	P	1	P	BA
128	P				
106	P				
102	3				
103	P	P	P	P	BA
87	3	P	P	P	BA
114	2	1	1	2	BCom
102	F				
104	F				
103	4				
109	P				
127	P	P	P	P	BA, BPh
102	F				
101	F				
104	F				
116	1	P	1	P	BA, BPh
110	2	1	F	P	BA
95	2	2			
100	3				

Table IX. - Otis IQ in Grade 12 and Subsequent Achievement by College Class. (Continued)

Grade 12 <u>Otis</u> IQ	College Academic Achievement				Degree Granted
	1st Year	2nd Year	3rd Year	4th Year	
99	F				
93	F				
126	P	P	P	P	BA
124	2	1	P	3	BA, BPh
104	P	P	3		
91	F				
93	3				

APPENDIX 3

HETEROGENEITY OF APTITUDE OF COLLEGE UPPERCLASSMEN

Allusion was made, on page 43, to the fact that the upper classes in college are heterogeneous with respect to academic aptitude. The variability in scholastic talent among college Freshmen was illustrated by a frequency distribution of Otis IQs classified according to category of Freshman achievement. A similar procedure will be followed here for each of the second, third, and fourth years of college. This information is found on the three immediately following pages in tables X to XII inclusively. These three tables parallel Table I, found on page 44.

The information tabulated on the following pages has been gathered from the raw data of the survey, presented in Appendix 2. The data pertains only to full-time students who followed the entire year in question in any faculty of the University of Ottawa between September 1943 and June 1953, and who had an Otis or Otis-Ottawa IQ obtained on the Higher Form while in Grade 12 at the University High School.

College achievement is determined by the number of subjects failed, according to the following system:

- A - passed the year by failing no subjects;
- B - passed conditionally, failing 1 or 2 subjects;
- C - passed conditionally, failing 3 or more subjects;
- D - failed the year.

Table X. - Frequency of Otis IQs Distributed by Category of Sophomore College Achievement.

Grade 12 <u>Otis</u> IQ	Sophomore College Achievement			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
130 - 134	1			
125 - 129	11	2		
120 - 124	17	4	2	1
115 - 119	21	6	2	3
110 - 114	23	15	4	4
105 - 109	24	22	4	2
100 - 104	19	16	2	1
95 - 99	14	11	-	-
90 - 94	3	8	1	3
85 - 89	1	2	1	-
80 - 84	<u>1</u>	<u>-</u>	<u>-</u>	<u>1</u>
Total Number	135	86	16	15
Mean <u>Otis</u> IQ	110.7	105.7	108.6	106.2
Standard Deviation	9.9	8.8	9.3	11.3

Table XI. - Frequency of Otis IQs Distributed by Category of Junior College Achievement.

Grade 12 <u>Otis</u> IQ	Junior College Achievement			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
130 - 134	1			
125 - 129	10	1		1
120 - 124	14	1	2	
115 - 119	16	4	1	
110 - 114	26	11	3	2
105 - 109	23	14	3	5
100 - 104	18	9	1	3
95 - 99	10	6	3	
90 - 94	3	5	1	2
85 - 89	1	3		
80 - 84		1		
Total Number	122	55	14	13
Mean <u>Otis</u> IQ	110.9	104.5	107.4	105.8
Standard Deviation	9.4	10.6	9.1	8.5

Table XII. - Frequency of Otis IQs Distributed by Category of Senior College Achievement.

Grade 12 <u>Otis</u> IQ	Senior College Achievement			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
130 - 134	1			
125 - 129	10			
120 - 124	14		3	
115 - 119	18			
110 - 114	31	5	1	
105 - 109	31	6	3	
100 - 104	23	2		
95 - 99	15	3	1	
90 - 94	6	2		
85 - 89	2			
80 - 84		1		
Total Number	151	19	8	-
Mean <u>Otis</u> IQ	109.5	103.3	112.0	-
Standard Deviation	9.5	8.2	8.6	-

APPENDIX 4

ABSTRACT OF

Local College Prediction with the Otis and the Otis-Ottawa

The aim of the study was to determine whether, and to what extent, academic success in college is predictable from a knowledge of scholastic aptitude test scores. An additional aim was to determine the value of a graphic predictive technique for this purpose.

The 369 subjects of the survey were former graduates of the University of Ottawa High School who continued their studies at any college faculty of this same institution during the period from September 1943 through June 1953.

The higher examinations of both the Otis Self-Administering Tests of Mental Ability and of their French-language equivalent, the Examens Otis-Ottawa d'habileté mentale, were used to obtain measures of scholastic ability. The Otis and Otis-Ottawa IQs obtained by these subjects in grade twelve in the course of the regular testing and guidance program were used as measures of their scholastic ability. The degree of academic success was determined by inspection of the individual's college record. Yearly achievement was described in each case as being one of four levels, namely, passing completely, passing conditionally

1 M.A. Thesis presented by Raymond F. Vaillancourt, in 1955, to the Faculty of Arts of the University of Ottawa, 91 pages.

by failing only one or two subjects, passing conditionally although failing three or more subjects, and failing the year.

The accumulated data, classified separately for each of the four years of the college course according to level of IQ and degree of achievement, were studied as to the relations and trends of the distributions. Analysis consisted in the critical evaluation of differences between statistics, and was supplemented by a graphic solution to the problem.

It was concluded that there is a significant but rather low relationship between aptitude and achievement in college. This relationship is most important in the Freshman year, scholastic predictability decreasing considerably in the subsequent college classes. Moreover, in all classes the greatest differentiation was manifested between passing students and probationary students who failed one or two subjects.

Finally, the graphic approach to prediction was shown to be a simple but effective technique in the study of this problem.

Raymond F. Vaillancourt, Local College Prediction with the Otis and the Otis-Ottawa, M.A. Thesis presented to the School of Psychology and Education of the University of Ottawa, 1955, xi-91 pages.

The aim of the study was to determine whether and to what extent, academic success in college is predictable from a knowledge of scholastic aptitude test scores. An additional aim was to determine the value of a graphic predictive technique for this purpose.

The 369 subjects of the survey were graduates of the University of Ottawa High School who continued their studies at any college faculty of this same institution during the period from September 1953 through June 1953.

The Higher Examination of both the Otis Self-Admins. Tests of Mental Ability, and of their French language equivalent, the Examens Otis-Ottawa d'habileté mentale, were used to obtain measures of scholastic ability. The Otis and the Otis-Ottawa IQ's obtained by these subjects in grade XII in the course of the regular testing and guidance program were used as measures of their scholastic ability. The degree of academic success was determined by inspection of the individual's college record. Yearly achievement was described in each case as being one of four levels, namely, passing completely, passing conditionally, failing one or two subjects, failing three or more subjects, failing the year.

It was found that there is a significant but low relationship between aptitude and achievement in college. This relationship is most important in the Freshman year, scholastic predictability decreasing considerably in the subsequent college classes. Moreover in all the classes the greatest difference was found between those who succeed, and the probationary students who fail one or two subjects.

Finally the graphic technique was found to be a simple but effective way of studying this problem.