THE CONTRIBUTION OF HIGH SCHOOL GRADES AND PUBLIC EXAMINATION RESULTS TO THE PREDICTION OF FIRST YEAR PERFORMANCE IN POST-SECONDARY TECHNICAL PROGRAMS AT THE COLLEGE OF TRADES AND TECHNOLOGY

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by

William George Colbourne 

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ABSTRACT

The purpose of this study was to investigate the degree to which first-year academic performance at The College of Trades and Technology, St. John's, Newfoundland, Canada, could be predicted by a student's high school evaluation, public examination evaluation, and composite shared evaluation results.

To carry out this study, a sample of 163 students was selected from courses in Business, Medical Sciences, and Engineering Technology at The College of Trades and Technology. For each subject in the sample final grades in each of the three measures of grade eleven performance were retrieved from the Department of Education public examination file and correlations were computed for each of these with first-year College grade point average. The major statistical procedure used in the study was the multiple regression analysis. The results of this investigation reveal that although the three predictors are approximately the same in their level of predictive accuracy, the combined shared evaluation results did predict significantly better than either of the two single predictors.

It was recommended that reliability and validity studies of the shared evaluation system be undertaken in an attempt to improve predictive efficiency. Further

study of the applicant pool, including the applicants' backgrounds, qualifications and other non-academic criteria, as well as a generalization of a study of this nature to investigate academic and non-academic criteria as predictors in other courses or other institutions, was recommended as a possible means of improving accurate prediction of academic performance.

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CHAPTER I

STATEMENT OF PURPOSE

The purpose of this study was to determine the accuracy of prediction of academic performance of students in the first year of selected two and three-year courses at The College of Trades and Technology, using the high school evaluation, the public examination evaluation and the student's composite score from these two evaluations as predictors.

BACKGROUND AND RATIONALE

History of the Use of Predictive Criteria

The problem of accurate academic evaluation and its subsequent use in the prediction of future academic performance has been an area of concern for researchers in education for more than half a century. Although some early research was conducted in the use of non-intellective factors in predicting academic achievement (Tyler, 1932; Scott, 1938), the prime focus for most of the early research was the use of intellective factors and records of previous performance for prediction purposes (Gilkey, 1929; Kellogg, 1929; Whitney, 1930; Clarke, 1931; Reeder, 1932).

The present concern with the prediction of academic performance, while being a natural progression from earlier research, has been given impetus by several factors which previously were not as important as they are now. The high growth of student population has greatly increased the competition among prospective students for entrance into the various post-secondary educational institutions. For a variety of reasons institutions are concerned with selecting those students who would most benefit from their instructional programs, and with screening out those who would be unsuccessful. Such a selection procedure may be beneficial to both the institution and the applicant. The institution benefits through maximizing the efficiency of its program since instructional resources are wasted when students fail. Also, the restriction of admission to only the best students may actually improve the quality of instruction. The student may also benefit from a selection procedure which rejects his application to a program in which he would have a high risk of failure. In this way he may be prevented from spending his time and energy at a task at which he cannot succeed.

These two perspectives, that of the institution and the student, are often at odds because the risk of failure acceptable to the institution is quite often not as great as the risk of failure acceptable to the student. This usually means that the entrance requirements set by

the institution and its policy of selecting from among those applicants who meet the minimum requirements results in a loss of opportunity for success from large numbers of students in the higher risk category. As this competition for admission increases, the search for an accurate predictor of academic performance has taken on increased significance.

Summary of Findings Related to Predictive Efficiency--Theoretical Rationale

As a result of the early research findings there developed among researchers the awareness that not all students of the same measured intellectual ability and performance level performed at equivalent levels in future situations. Subsequently, much of the later research on the prediction of academic performance was done on non-intellective factors, or a combination of these with the traditional intellectual criteria (Abelson, 1952; Johns, 1954).

Consistently, high school grades were found to be the best single predictor of post-secondary academic performance. In an attempt to improve upon the accuracy of prediction, many researchers investigated the predictive usefulness of standardized tests of academic aptitude when used in conjunction with high school academic record (Klugh and Bierley, 1959; Michael and Jones, 1963; Funches, 1967). Burnham and Hewitt (1972) investigated the pre-

dictive powers of the high school academic record, the average College Entrance Examination Board (CEEB) score, and a combination of these in the prediction of college performance. While they found that the predictive powers of the high school record and the CEEB score to be about equally good, at approximately .40, consideration of these scores in combination increased the predictability of college performance by .10.

The most frequent conclusion of this research was that while the record of high school academic performance was usually the best single predictor of future academic performance, the accuracy of prediction could be improved with the additional use of standardized test results.

Nature of Evaluation in Newfoundland, and its Subsequent Use as a Predictor of Future Academic Performance

High school performance as measured by the grade eleven public examination results has traditionally been used as the selection criterion in most post-secondary institutions in Newfoundland. In some instances, such as schools of nursing, this has been supplemented by scores on a standardized psychological test. However, even in this situation, final high school grades are given the greatest weight in selection procedures. The current standard procedure is to use a composite score made up of the total of the school's internal evaluation of the student,

plus the score received on the public examinations, to predict future academic performance.

The use of high school grades for prediction purposes has been supported by considerable research (Swenson, 1957; Guisti, 1964; Lavin, 1965; Menacker et al., 1971), but another important consideration for their use is their easy availability. This record is available for practically all students who are applying to post-secondary institutions, and a certain degree of standardization is assumed between schools, in that they are representative of similar courses of study, and similar instructional and evaluation procedures.

History of evaluation in Newfoundland. Warren (1967) reports that Newfoundland has had a coordinated system of public examinations for secondary education since 1893 when the Council of Higher Education was incorporated by an Act of Legislature. This body was responsible for prescribing the course of study and conducting examinations at the secondary level. From 1893 until 1918, these examinations were set and marked in England. For a few years following World War I the examination papers were set and marked in Canada, but this later reverted to the former system until 1931. In this year, Newfoundland became a member of the newly-created Common Examination Board of the Maritime Provinces, later renamed the Atlantic

Provinces Examining Board, and this played a major role in the setting and correction of high school examinations until 1969.

In 1949, the Council of Higher Education was abolished and the Public Examination Division of the Department of Education took over its functions. This division assumed the responsibility for the setting and marking of grades nine and ten academic examinations and grade eleven commerical examination papers. However, the Atlantic Provinces Examining Board retained the responsibility for the setting and marking of the grade eleven academic examinations.

In 1969, the Newfoundland Department of Education was reorganized and it was decided that the grade eleven academic papers would be set and marked locally. It was stated in the Department of Education Annual Report (1970) that "In recent years local favour has been expressed for withdrawal from the Board and the recommendation was made in the Warren Royal Commission on Education and Youth" (p. 37).

In September of 1969, the General Advisory Committee of the Department of Education took a serious look at the public examination system. Through a series of subsequent meetings the ideas of shared evaluation and total accreditation were discussed. It was felt that the total accreditation of schools and the abolition of public examinations was too drastic a move to be undertaken

without serious study of the situation (General Advisory Committee, 1969, 1970).

In 1970, the Minister of Education announced that commencing June 1971, grades nine and ten public examinations would be discontinued for a five-year period with grade eleven public examinations being retained. However, one year later, June 1971, a further decision was announced to change the system of grade eleven evaluation. It was decided that schools who met the specified criteria, and who wished to participate, could take part in a program of shared evaluation in which the school would assign fifty percent of a student's final grade eleven results, with the public examinations comprising the remaining fifty percent.

For the first year of this evaluation scheme forty-four percent of the province's one hundred and seventy-seven high schools participated (Table I). In 1972-73, this percentage increased to sixty-four percent, to eighty percent in 1973-74, and still higher in 1974-75 to include eighty-six percent of the province's high schools. In terms of student population, however, the percentage of students participating in shared evaluation was seventy percent, seventy-five percent, eighty-three percent and eighty-four percent for each of the first four years, respectively (Department of Education computer files, 1972-1975). From these statistics it becomes apparent that the majority of Newfoundland's grade eleven students were evaluated by the shared evaluation program during these years.

TABLE 1

Percentage of Newfoundland High Schools and High School Students Participating in Shared Evaluation for the Years 1971-1975

Year	Percentage of Schools Participating	Percentage of Students Participating
1971-72	44	70
1972-73	64	75
1973-74	80	83
1974-75	86	84

Source: Department of Education computer files, 1972-1975.

Use of grade eleven examination results in prediction. Because the grade eleven result is the major entrance criterion for all the province's post-secondary institutions, and since the majority of the province's grade eleven students have been participating in the shared evaluation program since its introduction in 1972, the question is raised as to the accuracy of prediction of post-secondary performance based on this new evaluation procedure. The program of shared evaluation for grade eleven examinations allows the participating schools to award fifty percent of the student's final grade. Prior to shared evaluation the student's grade eleven results were entirely the outcome of the one year-end final examination, set and corrected by an external agency. However, with the advent of the shared evaluation program, a student could now receive credit for successful work completed throughout the whole school year, including projects, class exams, term papers, and his general participation in the educational process. The provincial "public" examinations were still included as part of the student's evaluation, but constituted only fifty percent of his final grade, as compared to the former one hundred percent (Roebothan, 1973).

The grade eleven final examination results have been traditionally the screening device for entrance into most of Newfoundland's post-secondary institutions. With the introduction of the new evaluation system, there has

been no apparent change in this policy of using grade eleven final results for prediction purposes.

Significance of the Study

Through an investigation of the predictive validity of the school's internal evaluation of the student, the public examination results, and the student's final grade eleven results based on both these contributing elements, it was hoped to discover the best predictor of the three, and the degree to which that factor could be confidently used in the prediction of future post-secondary performance. It was hoped that this study would provide The College of Trades and Technology with research conclusions which would permit them to evaluate their present admissions policy, and, perhaps, be instrumental in improving the accuracy of their present screening procedure, or confirming the rationale for their present system.

On May 28, 1975, the General Advisory Committee passed a motion that full accreditation would be introduced in several schools commencing September 1976. That there was a desire among some educators to have full accreditation introduced into our schools is obvious from the results of a questionnaire distributed by the Department of Education. In April 1974, the Committee on Public Examinations distributed a questionnaire on accreditation to all superintendents, supervisors, principals of schools having grade

eleven classes, presidents of post-secondary institutions, and principals of all trade schools in the province. Of the one hundred and ninety-six returned questionnaires, one hundred and sixty-five indicated agreement for accreditation, seventeen disagreed, and fourteen were undecided (Public Examinations Committee, 1974).

It was this researcher's intention to investigate the predictive validity of the present internal evaluation by the schools participating in shared evaluation. It was hoped that this may indicate the degree to which the internal evaluation of students reflects the preparedness of schools for total accreditation. If it were found that the school's evaluation was as accurate, or more accurate, a predictor of future academic performance than was the public examination, then this research may provide some input into the decision to move toward, or avoid, total accreditation in Newfoundland's schools.

The predictive validity of the external evaluation of each student by the public examinations was also investigated. Since this examination is common to all students in a given year and graded by a common procedure, a certain degree of standardization may be assumed. Earlier research (Klugh and Bierley, 1959; Michael et al., 1962; Michael and Jones, 1963; Baird, 1969; Menacker et al., 1971) has demonstrated that, although the record of high school performance is the best single predictor of post-secondary

academic performance, the addition of standardized test results increased the level of predictability, in some instances by as much as .16 (Burnham and Hewitt, 1972). The combined result of the two components of shared evaluation, therefore, was investigated as a predictor of post-secondary performance in an attempt to discover if the combination of these scores significantly increased the level of predictive validity over that of each part separately.

HYPOTHESIS

The primary hypothesis of this study was that there is no significant difference in the accuracy of prediction of first-year academic performance at The College of Trades and Technology when using either the internal school evaluation, the public examination evaluation, or the composite shared evaluation results as the predictor.

DEFINITION OF TERMS

This section contains a brief explanation of terms used throughout this study.

Academic Grade Eleven: The course of study at the grade eleven level which requires the student to

successfully complete English, matriculation or honours Mathematics, and three other subjects, with an average mark of not less than sixty percent.

Academic Performance: Some method, usually numerical, of expressing a student's scholastic standing.

Accreditation: The status awarded to a high school by the provincial Department of Education whereby the high school is wholly responsible for awarding the total grade which determines the student's final academic grade eleven standing.

College: The College of Trades and Technology, St. John's Newfoundland, Canada, at which trades courses and technology programs are taught.

College Grade Point: A numerical value assigned on the basis of academic performance ranging from a grade point of zero for a performance of less than fifty percent, one for a performance of from fifty percent to fifty-nine percent, two for sixty percent to sixty-nine percent, three for seventy to seventy-nine percent, and four for a performance score of eighty percent or greater.

College Grade Point Average: This is the result when a student's total grade point achieved on his college final examination is divided by the total number of credits earned.

High School: A Newfoundland school in which the regular grade eleven program is offered. In usual practice, any of all of the grades seven through ten may also be offered in the school.

Post-Secondary: The level of education beyond high school for which successful completion of academic grade eleven is a prerequisite.

Public Examination Evaluation: The portion of a student's final grade eleven academic standing which is assigned by the provincial Department of Education on the basis of one set of end-of-year examinations common to all students and administered under the direction of the provincial government.

School Evaluation: The portion of a student's final grade eleven academic standing which is assigned by the individual high school on the basis of its internal criteria.

Shared Evaluation: The evaluation program in which the high school and the provincial Department of Education each independently award fifty percent of the grade which determines the student's final academic standing.

LIMITATIONS

1. Since the sample for this study includes only those students who have written end-of-year examinations at The College of Trades and Technology, the scope of this study is restricted to less than the total number of students admitted. No consideration is taken of the problem of identifying the potential dropout or predicting the student who leaves the course prior to end-of-year examinations.

2. This study is limited in that it considers subjects from a limited pool of selected courses at one post-secondary institution, and care should be exercised when attempting to generalize from the findings of this study to other courses or institutions.

3. A further limitation of this study is that it is limited to only successful applicants who have participated in the shared evaluation program. No consideration is given to students coming from accredited schools or from schools not participating in shared evaluation. No investigation is made of any bias which may exist as a result of a different evaluation procedure for these students.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The accurate prediction of post-secondary performance was recognized early as being of considerable importance in maximizing the efficiency of the system of education, and much of the earlier research in education was designed to investigate the predictive usefulness of various factors in the prediction of future academic performance.

Prediction Studies in Post-Secondary Education

Douglass (1931) reported that in a study of 811 students entering the University of Oregon in 1927 and 1928, the factor most highly correlated with the criterion of post-secondary performance was high school average. He observed that "No other coefficient of correlation between any one factor and college marks equalled or exceeded that obtained between average college mark and average high school mark (.56)" (p. 14). The results of this research were verified by Edds and McCall (1933) in their study of 85 freshmen admitted to Milligan College. They reported a correlation between high school average and first year college results of .65, .15 correlation points better than their intelligence test scores which correlated at .50

with college performance. Jones and Laslett (1935) found that in a study of 800 college freshmen, the best single predictor of college academic success was the high school composite mark which yielded a correlation coefficient of .65.

Gladfelter (1936) used the four-year average of high school grades in his study of freshmen performance at Temple University. He reported that this four-year average was a more accurate predictor of performance at college (.68) than grades in a particular subject or group of subjects.

Gelso and Klock (1967) investigated the effect of using various methods of computing high school average on the predictive powers of such an average. They computed high school average using only academic subjects for grades 9 through 12, academic and non-academic subjects for grades 9 through 11, and academic and non-academic subjects for grades 9 through 12. The resulting correlation coefficients with college performance were .50, .44, and .47, respectively. They concluded that there was no significant difference between the correlations of these different measures of high school average with freshmen average grades. These researchers also investigated the use of the SAT of the CEEB in the prediction of college performance. The relationship between these two scores yielded a correlation coefficient of .44. The researchers concluded that, although

some difference was observed between sexes, the high school average was the best predictor of academic performance for the sample as a whole.

Schmitz (1937), in a study of freshmen at St. Benedict's College in 1934, 1935, and 1936, reported a correlation coefficient of .64 between high school grade average and college success, and concluded that the students' high school grades appear to have the highest predictive value of college performance.

A large scale investigation was carried out by Segel and Proffitt (1937) using 10,404 cases from six institutions. A median correlation coefficient of .52 was reported between high school average and average college freshmen marks for all institutions. The highest correlation coefficient obtained was .66 with 763 cases at the University of Illinois. On the basis of their research, the researchers concluded that one of the best indices of student accomplishment in college is the high school average.

Similar findings were reported by Dwyer et al. (1940), Brown (1941), Webb and McCall (1953), Carlson and Milstein (1958), Henderson and Masters (1959), and Scannell (1960), all of whom report high school average as the best single predictor of post-secondary academic performance.

Although much of this research was done at the college or university level, similar results were found in studies done at community colleges and vocational training

schools. Lunneborg and Lunneborg (1969) investigated the relationship between the high school grades and the cumulative grade point averages for 2,890 students in agriculture, auto mechanics, data processing, engineering technology, electronics, secretarial science, and welding at six community colleges. They found that the performance of students in these courses was as predictable as in university courses. Baird (1969) found similar results in a study of 2,707 students in twelve curricular groups in 27 two-year colleges, both academic and occupational. Occupational course performance was found to be at least as predictable as academic performance using high school grade point average as the predictor. In the same study, Baird found that the high school grade point average was the best single predictor of college performance for both men (.44) and women (.54) in all curricular areas, better than partial or composite scores on the American College Testing Program (ACT) battery which correlate with college GPA at .31 for men and .39 for women.

From a scan of the literature, it can be observed that for the past half century the most accurate and most consistent predictor of post-secondary academic performance has been the student's performance at the high school level. As Giusti (1964) reported after an extensive study of previous research:

> The most significant conclusion resulting from the exploration of the field of prediction studies

> is the unquestionable superiority and stability of the high school grade average as a single source of data for predicting college success (p. 207).

Multiple Correlation Studies in Post-Secondary Education

In an attempt to improve the accuracy of the prediction of post-secondary performance, researchers in this area have investigated the use of multiple predictors, in particular, the use of the traditional high school average along with the student's performance on one or more standardized tests, to predict future performance.

Lunneborg and Lunneborg (1969) in a previously described study investigated the predictive accuracy of the high school record and the Washington Pre-College Testing Program (WPC) in the prediction of community college performance by freshmen students. They concluded that the high school average was the best single predictor of performance, with the highest single contributor being the high school English GPA which ranged from a high of .59 to a low of .20 for an average correlation of .35 with the various vocational criteria. They found that the WPC correlated at approximately .35 with the criteria, but found that this was significantly increased to .49 when the WPC results and high school average were combined.

In an earlier study, Klugh and Bierley (1959) investigated the School and College Ability Test (SCAT)

and high school grades as predictors of college achievement for all first-year students at Alma College for the fall term of 1956 and 1957. The authors report a correlation between SCAT score and College GPA for 1956 of .54 for men and .51 for women, and for 1957 of .59 for men and .67 for women.. The correlation between high school GPA and college GPA for 1956 shows .58 for men and .65 for women, and for 1957, .53 for men and .68 for women. However, when both SCAT and high school GPA together were correlated with college GPA, the correlations increased significantly to .670 for men and .684 for women in 1956, and .661 for men and .782 for women in 1957. The authors conclude that the use of a multiple correlation of the high school average and a standardized test, the SCAT, with college GPA give predictability significantly higher than that with any single predictor.

Spaulding (1959) carried out an investigation of the predictability of performance of 208 freshmen students at Colby Junior College using the Scholastic Aptitude Test (SAT) of the College Entrance Examination Board (CEEB), the Ohio State Psychological Test (Form 22), the College Qualifying Test (CQT) (Form B), the high school standing, and a statement from the high school of predicted success. The resultant correlation coefficients for each of these predictors with the criterion were .37 for the SAT, .42 for the Ohio State Psychological Test, .41 for the CQT,

.40 for high school standing and .46 for the high school prediction of success. However, these were substantially increased by means of a multiple correlation of the high school standing and predicted success with each of the remaining predictors. Multiple correlations yielded coefficients of .54 with the SAT, .57 with the Ohio State Psychological Test, and .57 with the CQT total. The data the researcher provides indicate that a significant improvement in predictive ability can be observed when a multiple correlation of a standardized test of academic ability and high school performance is computed with college academic performance.

An investigation of the high school record and College Board scores (CEEB) as predictors of freshmen academic performance at the University of Southern California was carried out by Michael et al. (1962). The conclusions they presented were that the high school grade point average is more predictive of success in college than either part scores or total scores on the CEEB, and a combination of high school GPA and CEEB scores yield a significantly higher predictive validity than does any one predictor, increasing from single correlations with college performance of .52 for high school GPA and .36 for total CEEB score, to .61 for a multiple correlation of high school GPA and CEEB scores with college performance.

Michael and Jones (1963) found similar results when using the scores on the SAT of the CEEB with the high school academic record to predict college performance. From their data single correlations with college performance of .48 for high school performance and .37 for SAT total score were found. By combining these two predictors in a multiple correlation with college performance, the predictive validity was increased to .52. They conclude that "A combination of high school record and scores on the SAT has yielded higher validation than has use of individual predictors" (p. 376).

The relative importance of the secondary school record and CEEB scores in the prediction of academic achievement was investigated by Burnham and Hewitt (1972). They also investigated the predictive validity of grading by letter grades as compared to the numerical continuous scale system. They concluded that numerical grades were better predictors than letter grades, and, also, that grades from the senior year of high school were best for prediction purposes. Single correlations were established for high school average with college performance and also CEEB scores with college performance. When the CEEB scores were combined with secondary school academic records for a multiple correlation with freshmen college performance, the correlation increased from .40 to .51 for the letter grade group and from .45 to .54 for the numerical grade

group. The researchers concluded that

> In very general terms, while CEEB scores and school records (unadjusted) were about equally good predictors of subsequent college achievement, their combination increased the correlation by about .10 (p. 24).

Summary

Since most post-secondary institutions do not have the facilities necessary to accommodate all those prospective students who apply, there exists a need to identify those applicants who would most likely succeed at the institution. Research during the post half century has reached the general conclusion that the most accurate single predictor of post-secondary academic performance is the high school average. In addition to this finding, it has also been observed that this predictor can be improved, usually by about .10 correlation points, by the use of the results of at least one of the various standardized tests of academic ability along with the high school academic record in a multiple correlation with post-secondary performance.

CHAPTER III

METHODOLOGY

This chapter provides a description of the variables in this study and describes the process by which the study was carried out.

GENERAL DESIGN OF THE STUDY

This study follows the design of ex post facto research as described by Kerlinger (1973) and Campbell and Stanley (1963). There was no attempt by the researcher to manipulate the independent variables of high school performance as measured by the shared evaluation program. The study was purely a correlational one, based on dependent and independent variables which were available prior to the commencement of this study.

THE SAMPLE

From the sampling pool of the various post-secondary institutions, The College of Trades and Technology was selected because, perhaps more than any other institution in Newfoundland, it is faced with the problem of selecting a limited number of students from a very large pool of applicants. Therefore, the accurate prediction of

academic performance is of vital importance to that institution, and the results of this study would, perhaps, be more beneficial to the College than to any other institution.

Because the purpose of this study was to investigate the predictive powers of the grade eleven shared evaluation system, the sample for the study was selected from only those courses for which successful completion of academic grade eleven was a prerequisite. The courses, described by The College of Trades and Technology as post-secondary courses, are of at least two years duration, with a maximum of three years of instruction in some programs.

The post-secondary courses at the College are grouped into three major departments, Business Education, Medical Sciences, and Engineering Technology. The courses in Business Education include Accounting, Business Administration, Secretarial Science, Community Recreation Leadership, and Food Management Technology. The Medical Science courses include Medical Laboratory Technology, Pharmacy, and X-Ray Technology. Civil Engineering Technology, Electronics Technology, Electrical Technology, Forest Resources Technology, and Surveying Technology make up the Department of Engineering Technology.

The writer consulted with the administration at the Trades College to investigate the similarity of course content among first-year courses within each department. Individual course subjects were compared and it was found

that the courses of Community Recreation Leadership and Food Management Technology bore little similarity to other first-year courses in the Business Education Department. Therefore, it was decided to omit students in these two courses from the pool of possible subjects for the study. Similarly, the course of Forest Resources Technology was sufficiently different from the other courses in the Engineering Technology Department to dictate its being dropped from consideration with the other courses.

The sampling pool consisted of all first-year post-secondary students at The College of Trades and Technology who wrote end-of-year College examinations in June of 1975 and 1976 in the courses of Accounting, Business Administration, Secretarial Science, Medical Laboratory Technology, Pharmacy, X-Ray Technology, Civil Engineering Technology, Electrical Technology, Electronics Technology, and Surveying Technology.

In a study investigating the relationship between academic achievement and alphabetic position of surname, Autry and Barker (1970) found that there is no significant difference in the relationship between these factors other than what might be expected by chance. Therefore, they concluded that the factors related to academic achievement are randomly distributed throughout the general population in a way unrelated to alphabetic position of surname. Based on this conclusion, this researcher took approx-

imately a fifty percent sample from each of the courses in the sampling pool by systematically selecting the first and every other second final first-year grade report for the 1975 and 1976 College examinations which were filed alphabetically by course name and year. From this sample, eleven subjects were identified as not having participated in shared evaluation during the previous year and were excluded from the sample, leaving a total sample of one hundred and sixty-three first year post-secondary students. The number of students selected from each post-secondary program can be seen in Table 2.

SELECTED VARIABLES

The problem of predicting College grade point average using high school and public examination results was essentially a statistical one. Grade points were awarded for each course subject according to the scale shown in Table 3. College grade point average was computed by the College by dividing the number of credits into the total points earned by the student.

The student's grade eleven average was computed in three different ways; first, using only the high school evaluation; second, using only public examination evaluation; and third, using the composite score which is made up of an equally weighted component of these two grades. The procedure used in computing each of these averages was

TABLE 3

The College of Trades and Technology Grade Point Marking System

Grade Received	Points Awarded
80% and over	4
70% to 79%	3
60% to 69%	2
50% to 59%	1
Below 50%	0

Source: CTT Prospectus, 1975, p. 116.

TABLE 2

Size of Sample Selected from each Post-Secondary Program for the Years Beginning 1974 and 1975

Program	1974	1975	Total
Business	36	31	67
Medical Sciences	32	29	61
Engineering Technology	19	16	35
Total	87	76	163

Enrollment variation by Program and Year: $X^2 = .036$, df = 2.

identical, with the only variables being the marks received from the various sources.

For Business Education students, high school averages were computed from grades received in English, Mathematics and the three highest electives. For students in Medical Science Technology and Engineering Technology, the high school average included English, Mathematics, the highest mark in a science, and the next two highest electives. This was in keeping with the entrance requirements set down by the College for each of these departments, and used the same computation of averages as was used by each department.

DATA COLLECTION

For each subject in the sample, the school evaluation, the public examination results and the students' total composite score were retrieved from the public examination computer file of the Department of Education. A new computer file was established containing this information from the Department of Education file, as well as each student's grade point average obtained from The College of Trades and Technology records, and the year of grade eleven and College examinations. It was from this file that the various statistical computations were performed.

STATISTICAL PROCEDURES

To investigate the nature of the sample selected from the College, an analysis of variance was carried out. This permitted a comparison of the various divisions across courses and years in terms of student past performance in high school, on public examinations, total grade eleven performance, and, as well, college performance as indicated by the grade point average.

Patterns of enrollment frequency were examined by the use of Chi-square. This would detect significant variations in student enrollment across year and course of study.

Simple Pearson product moment correlations were also computed between each of high school grades, public examination grades, and composite grade eleven score with college grade point average to determine the nature of the relationship between each pair.

The basic statistical procedure used to investigate the predictive usefulness of each of these three computed grade eleven averages in the prediction of the College grade point average was that of multiple regression analysis. This allowed the investigation of the proportion of variance of the College GPA which could be accounted for by the various predictors, singly, or in combination.

CHAPTER IV

ANALYSIS OF THE DATA

In this chapter the results of the various statistical procedures carried out on the data obtained for this study are described.

DESCRIPTIVE STATISTICS

Descriptive statistics on school examinations, public examinations and College grade point averages obtained by the subjects in the sample are shown on Tables 4 and 5. From a brief examination of the mean school and public examination scores shown in Table 4, it can be observed that the means of the sample in the various subject areas are considerably higher than the 67 percent school mean and the 55 percent public examination mean for the total population reported by Bull (1977).

RESULTS FROM SPECIFIC STATISTICAL PROCEDURES

Analysis of Variance

An analysis of variance was carried out to investigate the homogeneity of the sample by course and year on

TABLE 4

Means and Standard Deviations of School Grades, Public Exam Grades, and First Year Grade Point Averages of Students in Technology Programs at the College of Trades and Technology for the 1974-75 and 1975-76 College Years

	School		Public	
Subject	Mean	SD	Mean	SD
English	77.5	8.39	63.8	8.66
Algebra	82.8	10.27	75.2	14.66
Trigonometry	83.9	9.73	86.4	10.36
Elective 1*	83.7	8.22	75.3	12.94
Elective 2	82.3	9.13	76.6	11.06
Elective 3	78.0	10.11	69.9	13.83
Total	81.0	7.07	73.6	8.78

	Mean	SD
GPA	2.54	.697

*Electives 1, 2, and 3 represent the three next highest subjects other than the three compulsory subjects. For Medical and Engineering students, Elective 1 must be a Science subject. Therefore, the means reported for electives do not represent a specific subject.

TABLE 5

Sample Means for High School Evaluation, Public Examination Results, Total Grade Eleven Evaluation and College Grade Point Average by Course Division and Year of Enrollment

Course Division	Year	Sample Size	High School Mean	High School SD	Public Mean	Public SD	Total Mean	Total SD	GPA Mean	GPA SD
Business	Total	67	80.995	7.382	72.776	9.152	76.612	7.756	2.545	.643
	1974	36	81.417	7.991	75.639	9.920	78.222	8.616	2.464	.601
	1975	31	80.419	6.697	69.452	6.942	74.742	6.245	2.639	.686
Medical	Total	61	82.049	7.119	75.541	9.280	78.492	7.769	2.529	.740
	1974	32	82.844	6.065	79.125	5.896	80.688	5.710	2.532	.700
	1975	29	81.172	8.146	71.586	10.732	76.069	9.036	2.527	.794
Engineering	Total	35	78.057	7.600	70.457	8.494	73.943	7.503	2.499	.788
	1974	19	78.474	7.968	71.053	9.589	74.421	8.016	2.448	.869
	1975	16	77.563	7.366	69.750	7.225	73.375	7.060	2.559	.705
Total Sample	Total	163	80.742	7.438	73.313	9.215	76.742	7.844	2.529	.708

high school performance, public examination performance, total grade eleven performance, and college grade point average. The results are shown in Tables 6, 7, 8, and 9.

For the two years investigated in the study, high school average was not significantly different in any one course from year to year. However, across courses, there was a difference found to be significant at the .05 level of significance. This significant difference was also observed when using public examination grades. In addition, the public examination results were found to differ significantly by year as well as by course. This is consistent with the findings reported by Bull (1977) in a study of grading practices at the school and public examination levels. He reported that school grading tended to be more consistent from year to year than the grading on public examinations.

An investigation through analysis of variance of College GPA reveals that there is no significant difference between performance of students in each program for each of the years under consideration.

Chi-Square Test of Significance

A chi-square test of significance was performed to investigate enrollment by course and by year (see Table 2) to determine if the number of students varied significantly by course from year to year ($X^2 = 6.941$, $df = 9$). Similar

TABLE 6

Analysis of Variance of High School Average by Year of Enrollment and Course Division

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Value of F	Significance of F
Main Effects	421.094	3	140.365	2.582	0.054
Year	61.519	1	61.519	1.132	0.289
Division	363.312	2	181.656	3.341	0.037
Two-Way Interactions	4.750	2	2.375	0.044	0.999
Year Division	4.750	2	2.375	0.044	0.999
Explained	425.848	5	85.170	1.567	0.171
Residual	8535.168	157	54.364		
Total	8961.016	162	55.315		

TABLE 7

Analysis of Variance of Public Exam Average by Year of Enrollment and Course Division

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Value of F	Significance of F
Main Effects	1901.340	3	633.780	8.556	0.001
Year	1293.752	1	1293.752	17.465	0.001
Division	663.531	2	316.765	4.276	0.015
Two-Way Interactions	223.240	2	111.620	1.507	0.223
Year Division	223.240	2	111.620	1.507	0.223
Explained	2124.582	5	424.916	5.736	0.001
Residual	11630.262	157	74.078		
Total	13754.844	162	84.906		

TABLE 8

Analysis of Variance of Overall Grade Eleven Average by Year of Enrollment and Course Division

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Value of F	Significance of F
Main Effects	927.067	3	309.022	5.409	0.002
Year	464.928	1	464.928	8.138	0.005
Division	475.021	2	237.511	4.158	0.017
Two-Way Interactions	70.817	2	35.409	0.620	0.999
Year Division	70.817	2	35.409	0.620	0.999
Explained	997.887	5	199.577	3.494	0.005
Residual	8969.098	157	57.128		
Total	9966.984	162	61.525		

TABLE 9

Analysis of Variance of College Grade Point Average by Year of Enrollment and Course Division

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Value of F	Significance of F
Main Effects	0.520	3	0.173	0.339	0.999
Year	0.462	1	0.462	0.904	0.999
Division	0.056	2	0.28	0.055	0.999
Two-Way Interactions	0.170	2	0.085	0.166	0.999
Year Division	0.170	2	0.085	0.166	0.999
Explained	0.690	5	0.138	0.270	0.999
Residual	79.681	156	0.511		
Total	80.370	161	0.499		

Multiple Regression Analysis

The major statistical procedure used to analyze the data in this study was the multiple regression analysis. The relationship between the dependent variable, the College GPA, and the various measures of the predictor variable, the grade eleven average, may be seen in Table 12. The simple coefficient of correlation between GPA and high school average was .58. To these two factors was added the public exam average as an additional predictor. The resultant multiple correlation coefficient of .63 indicates that the correlation, and subsequently, the accuracy of prediction was improved by adding the second predictor, and this increase was found to be significant at the .01 level of significance.

A more comprehensive multiple regression analysis was carried out using the average school and public examination marks for each school subject as independent variables. Table 13 gives the results of this investigation. Of particular interest in Table 13 is the value of the squared multiple correlation coefficient. This statistic indicates that the overall predictive accuracy of the individual subjects, as shown by the last squared multiple correlation coefficient of .42, is approximately the same as that statistic obtained by using the average total grade and shown in Table 12 as .40.

TABLE 11

Partial Correlation Coefficients for College GPA with High School and Public Exam Averages

Correlation	Variable Controlled	r	r^2
GPA/High School	Public Exam	.24	.058
GPA/Public Exam	High School Exam	.30	.090

TABLE 10

Product Moment Correlations Between Grade Point Average and Grade Eleven Grades by Subject

Subject	Correlations GPA/School Mark	GPA/Public Exam Mark
English	.37	.35
Algebra	.44	.47
Trigonometry	.47	.46
Elective 1	.49	.48
Elective 2	.47	.39
Elective 3	.52	.43
School Average	.58	
Public Average		.60

School/Public Correlation Coefficient = .75

computations were performed to investigate the frequency of enrollment in each major division by year (X^2 = .036, df = 2). Both tests indicated that no significant difference was found in the frequency of enrollment by course, division, or year. This, of course, was the expected conclusion from an institution where there are more eligible applicants than can be accommodated, and all available space is usually filled.

Pearson Product Moment Correlation

Pearson product moment correlations were computed between College GPA and each of the two methods of computing grade eleven average, using only school marks and only public marks. The resultant correlations are presented in Table 10. It can be seen that the school/GPA correlation of .58 approximates very closely the public exam/GPA correlation of .60, and no significant difference was found between these two predictors. Partial correlation coefficients were calculated between GPA and school average controlling for public examination average, and between GPA and public examination average controlling for school average. The results can be seen in Table 11. The partial correlation coefficients represented by r indicate the amount of unique contribution each factor makes to the overall predictive accuracy of the total grade eleven results.

TABLE 12

Summary of Regression Analysis for Prediction of College GPA from School and Public Exam Averages

Order of Entry of Predictors	Variable Entered	Multiple Correlation[a]	Squared Multiple Correlation	Beta
School	School	.58	.34	.30
Public	Public	.63	.40	.37
Public	Public	.60	.36	.37
School	School	.63	.40	.30

[a]The Multiple Correlation in each case is significantly higher at the .01 level of significance than the correlation for each predictor independently.

TABLE 13

Summary of Regression Analysis of College GPA from Individual High School Subjects

Variable Entered		Multiple[a] Correlation	Squared Multiple Correlation	Beta
English	School	.36	.13	-.01
	Public	.41	.17	.10
Algebra	School	.52	.27	-.10
	Public	.57	.32	.20
Trig	School	.58	.33	.14
	Public	.59	.35	.14
Elective 1	School	.63	.39	.14
	Public	.64	.40	.08
Elective 2	School	.65	.42	.14
	Public	.65	.42	-.05
Elective 3	School	.65	.42	.08
	Public	.65	.42	.05

[a]Each multiple correlation represents the cumulative effect of the variable entered and all previous variables.

SUMMARY

The analysis of the data presented in this chapter revealed that the sample of 163 students from The College of Trades and Technology had a mean school evaluation score of 81 percent and a mean public examination score of 73.6 percent, considerably higher than the total student population for those years whose mean school grade was approximately 67 percent and mean public examination score was approximately 55 percent.

Analysis of variance revealed no significant difference in high school average of students between years in the same course. However, across courses a difference was found to be significant at the .05 level. This difference was also observed for public examination grades. No significant difference was found between performance of students in each program for each year of the study.

A chi-square test of significance showed no significant difference in the frequency of enrollment of students by course, division or year.

Pearson product moment correlations were computed for College GPA with each of high school and public exam averages giving correlations of .58 for high school and .60 for public examinations with the criterion. The difference in predictive ability of each of these variables was not found to be significant.

A multiple regression analysis considering both high school and public exam averages together as predictors of College GPA improved the level of correlation to .63, an increase found to be significant at the .01 level. The use of individual school subject grades as predictors, rather than the overall average, was not found to improve prediction significantly.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The major purpose for this study was to determine the degree to which the grade eleven high school evaluation, the public examination evaluation, and the composite shared evaluation results predicted future academic performance in selected first-year courses at The College of Trades and Technology, St. John's, Newfoundland.

This study involved an investigation of 163 first-year students at The College of Trades and Technology in selected courses from the Business, Medical Sciences, and Engineering Technology departments during the years 1974-75 and 1975-76. These students had all written public examinations and had participated in the shared evaluation program in the year immediately prior to their first year at the College. Although they had been admitted to the College primarily on the basis of the composite shared evaluation score, for the purposes of this study each contributing part was retrieved from the public examination computer file of the Department of Education.

Using the high school evaluation, the public examination evaluation and the composite shared evaluation results as predictors, correlational studies were made for each of these with the first-year grade point average at

the College to determine the level of predictive accuracy of each. The nature of the sample itself was investigated by carrying out an analysis of variance and chi-square test. The major investigation of the existence of a significant relationship was carried out using a multiple regression analysis to determine the degree to which the various predictors accounted for the variance observed in College GPA.

CONCLUSIONS

It can be observed from the mean school and public examination grades shown in Table 4 and Table 5 that the nature of the sample selected for this study is not necessarily representative of the general population of students who participated in the shared evaluation program in June of 1974 and 1975. Because of the restrictive nature of the selection procedure practised at The College of Trades and Technology, only students with above average academic standing were admitted to the program included in this study. In this way the institution could minimize the error of falsely admitting a prospective failure at the acceptable risk to the institution of falsely rejecting a student who would have been successful. Any institution which employs such an admissions policy would not have a student body representative of the general population and, therefore, any generalization made from this sample to

student populations in other post-secondary institutions must be made with caution.

The restrictive nature of the sample probably imposes some limits on the predictive efficiency of both the school grades and public examination results because of regression effects associated with measurement reliability.

Differences between courses on the predictor variables which are not associated with differences on the criterion suggest as well that the actual predictive efficiency of the independent variables within courses will be somewhat different than that found for the sample as a whole. The correlations reported must be regarded as applying to the students in the aggregated technical courses.

It is interesting to note that, while there was a significant difference for the total grade eleven average by both year and division, there was no difference observed in the investigation of grade point average at the College. This may indicate that students enter programs that are best suited to their level of ability. Assuming that students apply to only one of the technology programs, this would seem to suggest that while all the students accepted into the programs have above-average qualifications, the best qualified prefer some courses over others. Since the College would generally select those applicants with the best marks, it is probable that the applicant pool for some courses is better qualified than for others.

The apparent similarity in grade point averages in the various courses probably reflects a standardization of the marks awarded in the different courses, and is therefore not related to the quality of outcomes in other than a normative sense within each course.

The Pearson product moment correlation coefficients of .58 for school/GPA and .60 for public exam/GPA indicate similar levels of predictive power, and, in fact, no significant difference was found between the predictive powers of each predictor with GPA. This is a reflection of the relatively high level of correlation of .75 between school and public exam grades. If the grades are similar, then it could be expected that their correlation with a third measure would be similar.

A significant increase in the level of prediction was observed when the two predictors were combined to give a multiple correlation coefficient of .63 with college GPA. A more comprehensive regression analysis using individual school subjects did not result in a significant increase over the use of the average total grades.

It can be seen that the predictive power of the shared evaluation marks for admissions to The College of Trades and Technology compares quite favourably with the prediction studies reported in the review of the literature, and, therefore, would probably provide as efficient prediction as that which might be obtained using other qualifying examinations.

The combined mark is statistically more efficient as a predictor since addition of the school marks to the public examination marks reduces the standard error of prediction by 11 percent as the squared multiple correlation coefficient increases from .36 to .40. The improvement of efficiency is 17.6 percent if one adds the public exam marks to the school marks.

These facts would seem to bear significantly on the debate on full accreditation of schools as opposed to the continuation of the shared evaluation program. First, shared evaluation marks do provide better prediction than either school grades or public examination results, and can reasonably be substituted for other qualifying examinations. The use of specific qualifying examinations by post-secondary institutions can be anticipated as a consequence of the adoption of full accreditation, and this would impose an additional and, apparently, unnecessary burden on students applying for admission.

Second, the data are somewhat ambiguous, but suggest that, in this sample, at least, school marks are less efficient as a single predictor than the public examination results. This needs to be investigated more thoroughly, but should be resolved prior to a decision to adopt full accreditation.

The problem of cost-benefit becomes an issue in this context, because the data do suggest that the cost

in terms of loss of decision-making efficiency would be small if full accreditation were adopted, and that the savings through elimination of the public examination program would be large. This does not, however, consider the cost in terms of fairness to the students applying for admission, a factor which also needs to be considered before a decision is made.

RECOMMENDATIONS

1. Reliability and validity studies of both public examinations and school evaluations should be undertaken as a step toward improving predictive efficiency.

2. Further study of admissions at The College of Trades and Technology should be undertaken, focusing on non-academic admissions criteria, and predictive efficiency within each course.

3. A study of the applicant pools for each course should be carried out to learn differences in backgrounds and qualifications of applicants.

4. A generalization of this study should be extended to other courses and other institutions comparing the shared evaluation results with other qualifying examination predictors.

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