1979

A Multiple Regression Prediction Analysis of Preadmission and Postadmission Testing for Dental School

James Nicholas Kouracos
Loyola University Chicago

A MULTIPLE REGRESSION PREDICTION ANALYSIS OF PREADMISSION AND POSTADMISSION TESTING FOR DENTAL SCHOOL

by

James N. Kouracos

A Thesis Submitted to the Faculty of the Graduate School of Loyola University of Chicago in Partial Fulfillment of the Requirements for the Degree of

Master of Science

May

1979

ACKNOWLEDGEMENTS

For my friends. Dr. William F. Malone, Dr. James Sandrik, Dr. Douglas Bowman, and of course my loving and sensitive wife Joanne.

Those who would take over the earth
and shape it to their will
never, I notice, succeed.
The earth is like a vessel so sacred
that at the mere approach of the profane
it is marred
and when they reach out their fingers it is gone.
For a time in the world some force themselves ahead
and some are left behind,
for a time in the world some make a great noise
and some are held silent,
for a time in the world some are puffed fat
and some are kept hungry,
for a time in the world some are pushed aboard
and some are tipped out:
at no time in the world will a man who is sane
over-reach himself,
over-spend himself,
over-rate himself. LAO TZU (Circa 604 B.C.)

VITA

Biographical Data:

Name: James Nicholas Kouracos

Address: 8913 Grant Avenue
Brookfield, Illinois 60513

Date of Birth: July 9, 1950

Place of Birth: Chicago, Illinois

Education: Adlai E. Stevenson High School 1964-1968
Prarie View, Illinois

Augustana College 1968-1972
Rock Island, Illinois
Bachelor of Arts June 1972

Loyola University School of Dentistry 1972-1979
Maywood, Illinois
Doctor of Dental Surgery June 1976
Master of Science May 1979

Specialty Certification:
Fixed Prosthodontics January 1978
Orthodontics May 1979

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CONTENTS FOR APPENDICES

INTRODUCTION

There has existed among dental educators a diversity of opinion accompanied by disconcertion concerning the Dental Aptitude Test (DAT). The literature is divided; some consider its test contents irrelevant and/or unpredictable while others have difficulty interpreting and evaluating the results.

Convergence was found, however, in the necessity of administering a qualifying examination or battery of examinations which will predict with accuracy the performance of a prospective dental student. [1]

Current socioeconomic trends mandated increased dental proficiency. Selection of a given student assumed grave administrative implications. Attempts to forecast competency in dental school should be based on fact. This compelled admissions committees to identify qualified candidates by implementing reliable predictors. Unsatisfactory selection procedures manifested themselves in an inordinately high attrition rate and/or prolonged education and training which have resulted in a loss of resources.

The purpose of this investigation was to illustrate

---

[1] P. Joseph Phillip and William Reitz, "Statistical Models for the Selection of Applicants for the DDS Program," J. Dent. Educ., (March 1971), 150-151.

the predictive qualities of the existing DAT. One hundred and seven students were administered a second DAT one month prior to graduation from dental school. All their previous academic records, test scores and results on the Dental National Boards were also utilized to determine the more predictive aspects of examinations and grades. The entire accumulation of preprofessional and professional data was subjected statistically to a multiple regression analysis.

It is hoped the dental educator will be aided by this investigation for developing more prudent selection criteria for student admission in professional school.

REVIEW OF RELATED LITERATURE

Historically, dental educators have wrestled with the complex problem of applying consistent criteria to dental school admissions. The American Dental Association Council on Dental Education (1956) stated: "The problem of using the dental aptitude battery, or any other screening device effectively, is not so much the device itself as it is the identification of the criteria or yardsticks against which to make comparison." Faced with an expanding socioeconomic backdrop, dental schools were faced with identifying predictors of success in dental school for the students who were being considered for rosters of the incoming classes.

The need for more comprehensive assessment of prediction measures and procedures of evaluating student achievement in dental school precipitated the implementation of the DAT in 1946. In November 1950, the first nation-wide DAT was administered for the entering class of 1951. Peterson (1948) wrote: "The aptitude testing program is collecting data which are proving that the performance of students in dental school can be predicted with a high degree of accuracy." This statement was prompted from a statistical analysis of the 1946-47 and 1947-48 freshman dental students.

Optimism was enhanced when Ginley (1966) reported

after fifteen years of compulsory administration of the DAT to all dental school applicants, the average attrition rate had dropped to 5%. Prior to 1943, it exceeded 20 to 30% (Smith 1948) and in 1950 it averaged 15%. Federal capitation emerged as an important factor which decreased the percentage of failure grades distributed.

Additional predictive factors surfaced. McGrath (1942) believed the grade point average (GPA) of the undergraduate basic sciences produced an additional reliable index for the prediction of student success in dental school. However, in 1952, Weis (1952) cautioned test scores among groups from previous years cannot be used as an indicator of the reliability for subsequent groups because the latter cannot be considered as belonging to the same population. He proposed the DAT, when used in combination with preprofessional grades, permitted only a moderately high correlation with dental school grades.

The statistical analytic fires were stoked with the intent to focus on the best success predictors for dental student success. Blommers (1956) used a multiple regression analysis with 109 subjects. He observed neither the total number of semester hours of predental study nor the overall undergraduate GPA contributed meaningfully as predictors of dental school accomplishment. Podshadley et al.

(1969) reported predental GPA was the best predictor of sophomore dental school GPA (this GPA represented a high degree of academic, nonclinical weight) out of a field of variables which also included the DAT and CPT (California Performance Test). He also found, with the possible exception of verbal reasoning, quantitative reasoning, and carving dexterity subtests of the DAT, all other DAT subscores factored together to give only one predictive input.

Factor analysis is a data reduction system which allows a limited set of "factors" to represent a much larger matrix of correlation coefficients. Full and Foley (1971) used 119 participants to segregate three stable factors for student success: 1) academic potential; 2) dexterity and spacial analysis; and 3) anatomy survival (lab and lecture grades from the freshman dental gross anatomy course). Zullo (1971) also identified three factors, but differed as to their make-up. Of the thirteen subtest scores comprising the DAT, he saw three factors surface. They were: 1) verbal/science; 2) abstract reasoning (spacial relation and quantitative reasoning); and 3) carving dexterity. Of consequence to note was that spacial analysis and carving dexterity did not load onto the same factor. The implications seemed evident. The total time of the test could be reduced either by the total

number of tests or the number of items in the test. The factor analysis indicated predictive redundancy. Zullo stated: "Since it is generally accepted that factor analysis scores are more stable than individual test scores in a multiple regression equation, it might be well to explore the possibility of using these factor scores in such an equation for prediction of success in dental school."

With a sample size of 148, Trocchini and Eudey (1961) concluded undergraduate GPA, the academic portion of the DAT, and marital status were significant predictors of dental school achievement. Their predictive formula was: predicted grade point average for dental school = 0.410 X undergraduate GPA + 0.068 X academic score on the DAT + 1.390 if married or 1.190 if not married.

Chen and Podshadley (1967), with the aid of factor analysis, delineated two predictive factors present in the thirteen subscores of the DAT. These were identified as science plus spacial relations and manual average. Again, as in Zullo (1971), physical and mental manipulative dexterity testing did not load as a single constituent.

Dworkin (1970) identified three factors out of the DAT subtests. The factors were: 1) science; 2) manual ability; and 3) intelligence. Spacial relations and carving comprised the same determinant. Empirically, it was

concluded that DAT chemistry, undergraduate GPA, years of undergraduate college, and spacial relations scores occurred more frequently among the four best predictors than any other variables. Previously (1970) Dworkin demonstrated freshman and sophomore theory grades correlated strongly with many of the DAT subtest scores; moreover, freshman and sophomore technique grades correlated significantly with a different set of DAT scores (manual average and spacial relations). No systematic pattern existed between junior and senior dental school grades and the DAT. Although the findings were consistent, the correlations were all low enough to question their usefulness.

Emphasis in the literature appeared to reinforce the undergraduate GPA as a stable predictor of dental school success. Hood (1963) with a sample size of 300, showed with a multiple regression analysis a high correlation between predental GPA and the freshman dental GPA when viewed as a single predictor, regardless of the college attended. Academic average also was linked substantially with freshman dental GPA. Hood found a prediction based on chemistry knowledge, biological knowledge, chalk carving, and spacial relations was as accurate as that based on the use of all subtests combined. Heller et al. (1965) reported undergraduate GPA and undergraduate science GPA acted

consistently as much better predictors of first year dental school grade average than did academic or manual scores of the DAT. Fredericks and Mundy (1968) opposed these conclusions. They observed no significant relation between the average science grade in college and academic standing for either first or second semester of the first year of dental school. Further publication in the same year added to the confusion. Fernandez-Pabon (1968) found in three classes of dental school students there was no significant correlation (0.05) between science GPA in college and basic science GPA in dental school or between the number of college science credits and dental school science GPA. Kreit (1968) ended the year by indicating undergraduate GPA was the best single predictor of student success in dental school.

Manhold and Manhold (1965), using a sample size of 140 students in four different classes at dental school, stated performance in basic sciences was highly predictive of clinical endeavors. The correlation was 0.40 which was significant at the 0.01 level. Manhold and Manhold's (1967) conclusion was "The DAT per se is more efficacious than any of its parts in predicting the four year performance of the dental student." The author explained part of the inconsistencies presented in the 1965 article were due to differ-

ences from class to class on the individual compont tests of the DAT.

Manhold and Manhold were not the first to cite the shortcomings of predictive analysis. Webb (1958) studied the first six classes to come under the DAT program at a single school. The intent was to establish validity of the DAT compared with preprofessional GPA in predicting freshman dental school grades. The results showed a high degree of variability in correlation from year to year. Travers and Wallace (1950) found the DAT battery had little value as a predictor for one class at the University of Michigan School of Dentistry, but was of considerable value for another class. Similar conclusions were substantiated by Manhold and Manhold (1965). Ross (1967) suggested one reason for conflicting data in previous literature on prediction of student success in dental school was the lack of consideration of individual class characteristics. Due to prevailing socioeconomic conditions, the calibre of applicants might change from year to year. There are also variations in grading systems produced by course content and faculty. Ross' study established rank correlations over the four year dental education of a single class of ninety - three students. He found insignificant correlation between preprofessional GPA ranking and a ranking

based on dental curriculum. There was "moderately high significant correlation" between the ranking based on DAT scores and the final dental ranking. Ross concluded the DAT was best used to eliminate nonqualified applicants rather than to predict success in dental school.

Durocher (1975) surfaced the fact admissions committees must closely scrutinize the priority given to grades. He stated, "Grade inflation is often for the purpose of having one's students gain admission to postbaccalaureate programs."

Most currently, Phillip and Reitz (1971) wrote, "An analysis of data should be made in order to identify those variables which individually, or in combination with other variables, discriminate between successful and unsuccessful students." Phillip and Reitz used a correlation matrix with a sample size of 790 students with a 100 subsample for cross validation. He concluded chemistry HPA (honor point average) and science HPA at the undergraduate level appeared as the best discriminators. Total hours of college credit showed little correlation. With the DAT, those subtests which measured technical knowledge and skill emerged as the best discriminators. Two predictive factors became apparent. First was science which embodied undergraduate chemistry, biology, science, and physics HPA along with

the DAT subtests of chemistry, biology, total science, science application and factual science. The second factor was technical. This included spacial relations, carving dexterity and manual average of the DAT battery. Undergraduate chemistry HPA distinguished between two groups of students, one that was successful in dental school and one that was not. Data showed groups of successful and unsuccessful dental students differ more in their chemistry, physics and total science HPAs than they do in either total hours of biology or total hours of science.

Smith and Hill (1972) implemented a sample size of 154 individuals and found there was significant correlation (0.05) between the quality of undergraduate science GPA and student success in dental school, with no correlation between the latter and the quantity of undergraduate hours when compared to dental basic science courses.

Cianflone et al. (1975) used ninety-five students of a dental school graduating class. Their results showed that regardless of preprofessional major, no significant difference was found to surface as an adequate predictor of academic success in dental school. The authors suggested the selection of the preprofessional major course of study may bear little relationship to academic performance in dental

school.

Specifically, the chalk carving subtest of the DAT battery has come into close scrutiny. This subtest was part of the battery from the years 1949 to 1972. In 1973 it was replaced by a paper-pencil test (perceptual motor ability test or PMAT). Some disadvantages of the test were that it was costly and untidy. The chalk was of a special formula and necessitated the use of bench laboratory facilities. The test results were scored by a committee of the American Dental Association in Chicago consisting of seven to eight members. Logistics and cost became prohibitive for continued use of the chalk carving test.

Peterson (1974) reported the purpose of the chalk carving test was not to predict grades in technique or theory courses, but to ".....enable admissions committees to keep a student with 'five thumbs' out of dental school and save that place for a more worthy applicant. Only the chalk carving tested whether information could pass from an applicant's brain to his hands and fingers". The current replacement test is basically an extension of the spacial relations subtest.

Derevere (1961) studied 118 students. He found coefficients determined for correlating chalk carving and

spacial relations scores with each other and with operative dentistry grades suggested the elimination of one of these tests due to redundancy in prediction. Graham (1972) noted the predictive value of the DAT battery was not diminished by substituting the PMAT for the chalk carving. Zullo (1971) tested 100 students with the PMAT and found the test to load negatively on a dexterity factor and positively on perceptual or spacial relations factors. Chalk carving was shown to be a rather poor predictor of dental school achievement. However, dental school achievement, as measured by grades is basically cognitive whereas the chalk carving test measures a specific ability of the psychomotor domain.

On the basis of predicting success in dental school from freshman dental school grades, Phipps et al. (1968) calculated all DAT subtests and undergraduate GPA variables predicted freshman dental school success and these, in turn, were predictive of four year dental school performance. The authors' end conclusion was freshman achievement was a good indicator of four year success. This was opposed by Houston and Mensh (1975) who tested 370 subjects. They found performance in the first two years of dental school was more reliably predicted than the second two years of dental school and academic achievement better predicted suc-

cess than did preclinical laboratory performance.

Hutton (1969) drew inconclusive results of the validity of personality testing as a predictive function for dental school success. His sample was 108 seniors from thirty-five dental schools. He also concluded the carving dexterity subtest of the DAT battery was of little, if any, predictive value for student success in dental school.

In closing, Jacobs et al. (1973) indicated the admissions to dental school at the University of Iowashave resulted in the exclusion of nonscience-orientated individuals. Yet students with sensitivity and community orientation are needed. The authors suggest the apparent overemphasis on science requirements by admissions committees play a role in restricting the heterogenity of dental students in terms of academic majors. The survey showed DAT scores of undergraduates with predentistry majors at the time of testing were found to be higher than those attained by students of that group who actually applied for dental school admission. This was the reverse for the College of Medicine with MCAT scores. The authors suggest there was a vocational maturation away from dentistry. This may be the result of disenchantment with confining predental requirements in the field of science.

Psychological testing has been purported by dental

educators, but implementation has been fragmentary and the results divergent. Yates (1976) identified subgroups of freshman dental students with salient polarization of personality types. Also eluded to were personality differences which existed between freshman dental and medical students. Fuller et al. (1979) attempted to identify persons who would make "good" dentists. Investigators employed the Selection Research, Inc. Dental Perceiver interview and demonstrated this instrument to be a valid screening tool for applicants. The highest correlations were linked with predictions associated with clinically orientated variables. The interview resulted in minimum duplicity of success prediction information and augmented traditional measurements used in admissions procedures.

METHODS

SUBJECTS:

This paper will report the records of a four-year test-retest of the DAT for 107 senior dental students of the 1971 graduating class at Loyola University School of Dentistry (Appendix A).

PROCEDURES:

The data was subjected to a computerized multiple regression analysis. The statistics included: pre-professional grade point averages (science only: SCIGPA and cummulative: COLGPA); both initial freshman admission DAT (IDAT) and senior DAT retest (SDAT) scores; the four years of dental academic achievement records; along with the National Board (NATLBD) scores for the respective students.

Because the dental aptitude tests are designed to predict in two areas, the theoretical (or academic) and the technical (or manual), two composite or average scores are included on each test report. The Academic Average (ACADAV) is an average of the quantitative reasoning, verbal reasoning, reading comprehension, factual science, and science application scores. The Manual Average (MANUAL) is an average of the space relations and the carving dex-

terity scores.

QUANTITATIVE REASONING (QUANTR): Quantitative reasoning or numerical ability is the talent to reason with numbers, to manipulate numerical relationships, and to deal intelligently with quantitative materials.

VERBAL REASONING (VERBAL): Linguistic ability or verbal reasoning is the adeptness to use and understand the meaning of words.

MENTAL LEVEL (MENTAL): This score is the combination of the QUANTR and VERBAL scores. It is sometimes referred to as an intelligence score. This instrument has broad norms, and by means of the scores on this test it is possible to compare dental applicants with college populations in general.

READING COMPREHENSION (RDCOMP): This subtest measures the candidate's capacity to read, organize, analyze, and comprehend new information. It is a yardstick of reading comprehension and is not a speed test.

The science subtests are designed so a high degree of knowledge in chemistry and biology is not requisite, but a complete lack of elementary knowledge of the terminology would lower the applicant's score.

BIOLOGICAL KNOWLEDGE (BIOLKN): This subtest measures the candidate's knowledge of the elementary principles of biology and his ability to apply these principles.

CHEMICAL KNOWLEDGE (CHEMKN): This score is a measure of the applicant's knowledge of the elementary principles of chemistry and his ability to apply these fundamentals.

FACTUAL SCIENCE (FACTKN): This includes an analysis of the principles of both biology and chemistry.

SCIENCE APPLICATION (SCIAPP): This is a computation of the ability to apply both biological and chemical fundamentals.

TOTAL SCIENCE (TOTSCI): The test score represented here is a combination of the above and reflects the knowledge of factual information in biology and chemistry and the applicant's capacity to apply this information.

SPACE RELATIONS (SPACER): The object visualization or space relations test surveys the ability to visualize and the capacity to manipulate three demensional patterns mentally.

CARVING DEXTERITY (CARVDX): The chalk carving test

gives an indication of how well a candidate can follow directions and visualize in three demensions, as well as his manual dexterity.

RESULTS

Multiple regression was employed rather than individual correlation coefficients because it allows some determination of the additional predictive power of several variables working together. It gains its maximum predictive power when the addition of new predictors into the equation do not significantly contribute added prediction. The computer ranking of the additive predictor values (regression steps) was determined at $F \geq 1.00$. Above this value, additive prediction for multiple R^2 was considered significant. The additive value discrimination equation was:

$$F = \frac{[R^2 (\text{step}_i + 1) - R^2 (\text{step}_i)]}{\frac{[1 - R^2 (\text{step}_i + 1)]}{N - N_{var} - 1}}$$

where R represents the multiple R generation through multiple regression. Multiple R values range from 0.00 to 1.00 and depict the scatter of point coordinates away from a line drawn through the scatter which best represents its orientation (Appendix C). The 0.00 multiple R indicates perfect random scatter in a circular fashion while 1.00 depicts a pure line generation of available points.

Prediction lines were produced for each of the pre-

diction problems:

1) freshman dental grade point average (FRGPA)/ initial dental aptitude test (IDAT); undergraduate college grade point average (COLGPA); undergraduate science grade point average (SCIGPA)
2) sophomore dental grade point average (SOGPA)/IDAT; COLGPA; SCIGPA
3) junior dental grade point average (JRGPA)/IDAT; COLGPA; SCIGPA
4) senior dental grade point average (SRGPA)/IDAT; COLGPA; SCIGPA
5) cummulative dental grade point average (FINGPA)/IDAT; COLGPA; SCIGPA
6) FRGPA/dental senior year retest of the DAT (SDAT); COLGPA; SCIGPA
7) SOGPA/SDAT; COLGPA; SCIGPA
8) JRGPA/SDAT; COLGPA; SCIGPA
9) SRGPA/SDAT; COLGPA; SCIGPA
10) FINGPA/SDAT; COLGPA; SCIGPA
11) National Board Scores (NATLBD)/IDAT; COLGPA; SCIGPA
12) NATLBD/SDAT; COLGPA; SCIGPA
13) NATLBD/FINGPA

The generation of the linear equation ($y = bx + a$) representing the individual scatter plots was derived from

the table of residuals using:

$$b = [\text{multiple R}] \times \frac{\text{standard deviation: dependent variable}}{\text{standard deviation predictor}}$$

$$\text{standard deviation predictor} = \sqrt{\frac{SSx}{N-1}}$$

$$SS_x = \Sigma x^2 - \frac{(\Sigma x)^2}{N}$$

The table of residuals was calculated as the numerical prediction of the independent variable given the dependent.

Correlation coefficients were also integrated into the analysis. The intent was to help establish the distribution of the points about the prediction line. Correlation coefficients range from -1.00 to +1.00. With N = 107 limits of statistical significance were calculated at 0.170 for significance at the 0.05 level and 0.23 at the 0.01 level.

The individual summary tables were structured to enable the reader to identify the variables which contributed to prediction with the most weight ($F \geq 1.00$). The actual F value is noted in parentheses. Variables with F scores below 1.00 are listed in order of decreasing additive prediction value.

The graph illustrations depict a prediction line generated from the individual problem table of residual

values (Appendix B). The line drawn best portrays the cloud of scattered coordinates for prediction (Appendix C). Statistical usefulness can best be derived from the summary data tables which allow examination of scatter in terms of additive predictive value, multiple R, and significance as it pertains to correlation coefficients.

FRGPA/IDAT; COLGPA; SCIGPA TABLE 1

$F \geq 1.00$ (F = 1.71)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.41	(.01)	0.17
ACADAV	4.68	0.96	0.14		0.18
DEPENDENT					
FRGPA	2.68	0.35			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

MANUAL, FACTKN, BIOLKN, VERBAL, MENTAL, TOTSCI, SCIAPP
CHEMKN, QUANTR, RDCOMP, COLGPA, CARVDX, SPACER

TOTAL MULTIPLE R = 0.44

SSx = 0.42

PREDICTOR EQUATION LINE = Y = 0.23(x) + 2.06

FRGPA / IDAT; COLGPA; SCIGPA

(Freshman Grade Point Average/Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

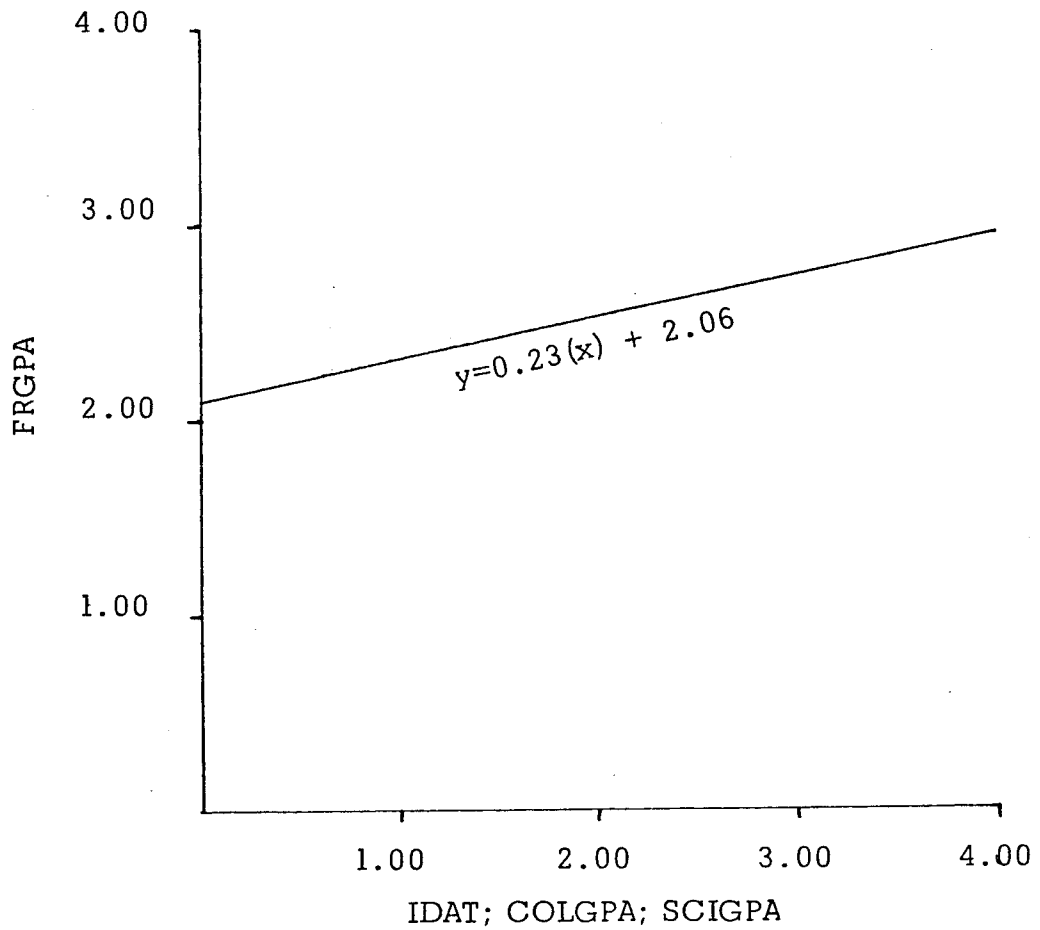


Illustration 1.

SOGPA/IDAT; COLGPA; SCIGPA TABLE 2

$F \geq 1.00$ (F = 9.68)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.29	(.01)	0.29
DEPENDENT					
SOGPA	2.46	0.34			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

SCIAPP, VERBAL, RDCOMP, FACTKN, TOTSCI, CHEMKN, MENTAL, QUANTR, ACADAV, BIOLKN, CARVDX, MANUAL, SPACER, COLGPA

TOTAL MULTIPLE R = 0.34

SSx = 1.92

PREDICTOR EQUATION LINE = Y = 0.73(x) + 0.66

SOGPA / IDAT; COLGPA; SCIGPA

(Sophomore Grade Point Average/Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

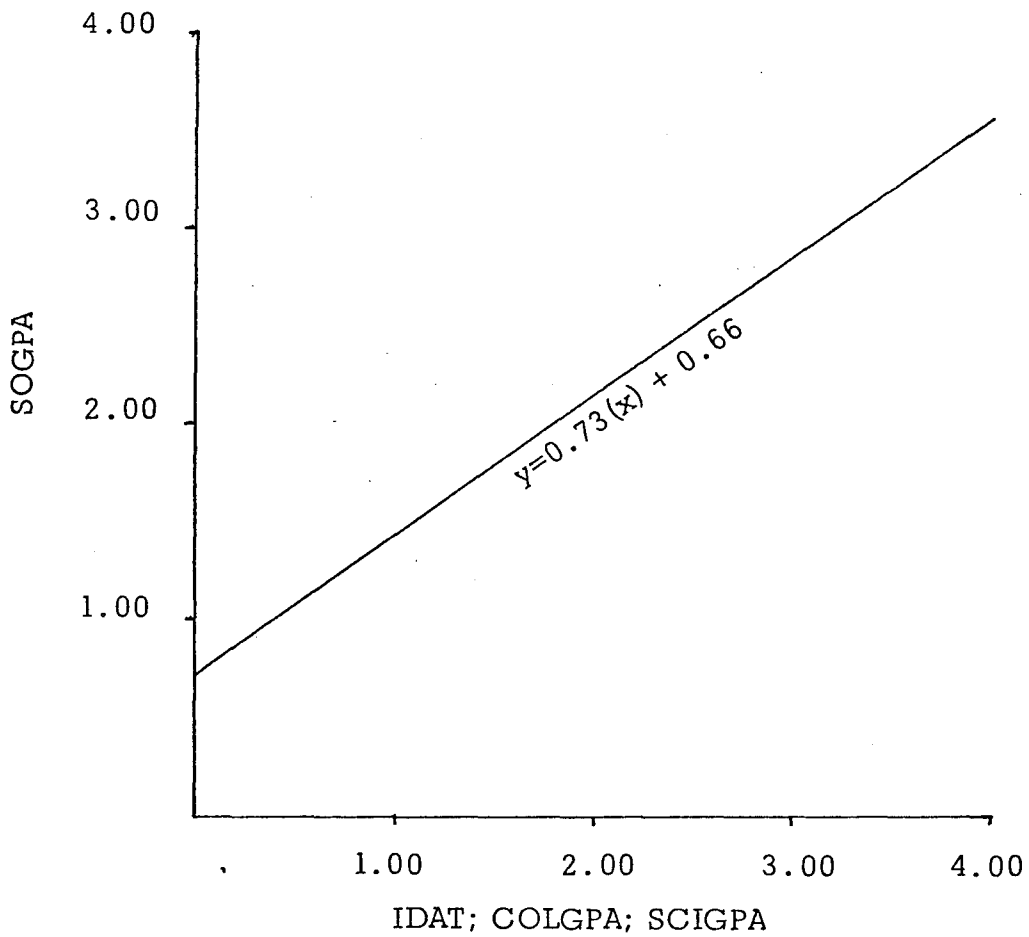


Illustration 2.

JRGPA/IDAT; COLGPA; SCIGPA TABLE 3

F≧1.00 (F = 1.24)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.20	(.05)	0.20
CARVDX	5.52	1.82	0.16		0.28
FACTKN	4.73	1.67	-0.13		0.31
TOTSCI	4.85	1.49	-0.08		0.33
SCIAPP	4.75	1.54	-0.03		0.35
QUANTR	4.39	1.81	0.11		0.37
ACADAV	4.68	0.96	-0.10		0.38
DEPENDENT					
JRGPA	2.90	0.27			

F<1.00 (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

COLGPA, SPACER, RDCOMP, MANUAL, CHEMKN, VERBAL, MENTAL, BIOLKN

TOTAL MULTIPLE R = 0.41

SSx = .84

PREDICTOR EQUATION LINE = Y = 1.16(x) -0.46

JRGPA / IDAT; COLGPA; SCIGPA

Junior Grade Point Average/Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

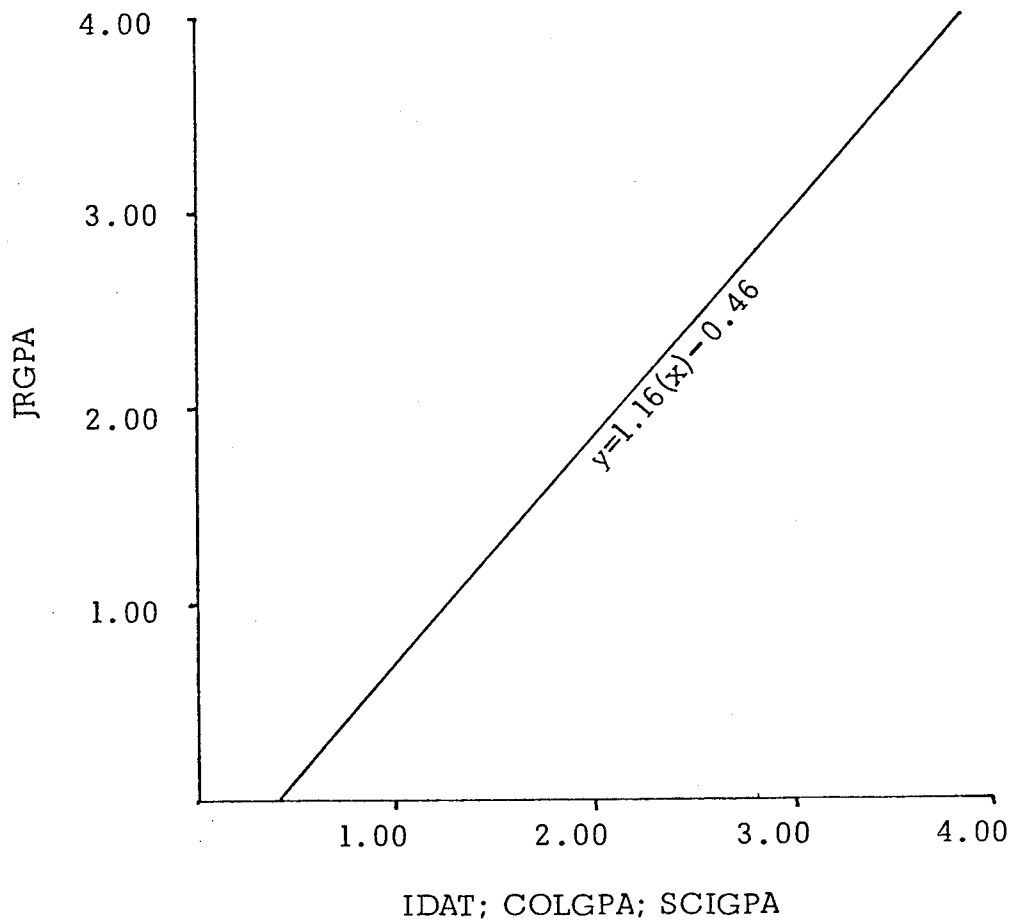


Illustration 3.

SRGPA/IDAT; COLGPA; SCIGPA - TABLE 4

$F \geq 1.00$ (F= 1.24)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
ACADAV	4.68	0.96	-0.26	(.01)	0.26
SCIGPA	2.41	0.27	0.16		0.31
CARVDX	5.52	1.82	0.18	(.05)	0.34
RDCOMP	4.78	1.49	-0.05		0.36
COLGPA	2.46	0.24	0.15		0.38
FACTKN	4.73	1.67	-0.22	(.05)	0.39
TOTSCI	4.85	1.49	-0.18	(.05)	0.41
SCIAPP	4.75	1.54	-0.13		0.42
DEPENDENT					
SRGPA	3.26	0.28			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

MENTAL, QUANTR, VERBAL, CHEMKN, MANUAL, BIOLKN, SPACER

TOTAL MULTIPLE R = 0.44

SSx = 1.08

PREDICTOR EQUATION LINE = Y = 1.16(x) - 0.52

SRGPA / IDAT; COLGPA; SCIGPA

(Senior Grade Point Average/ Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

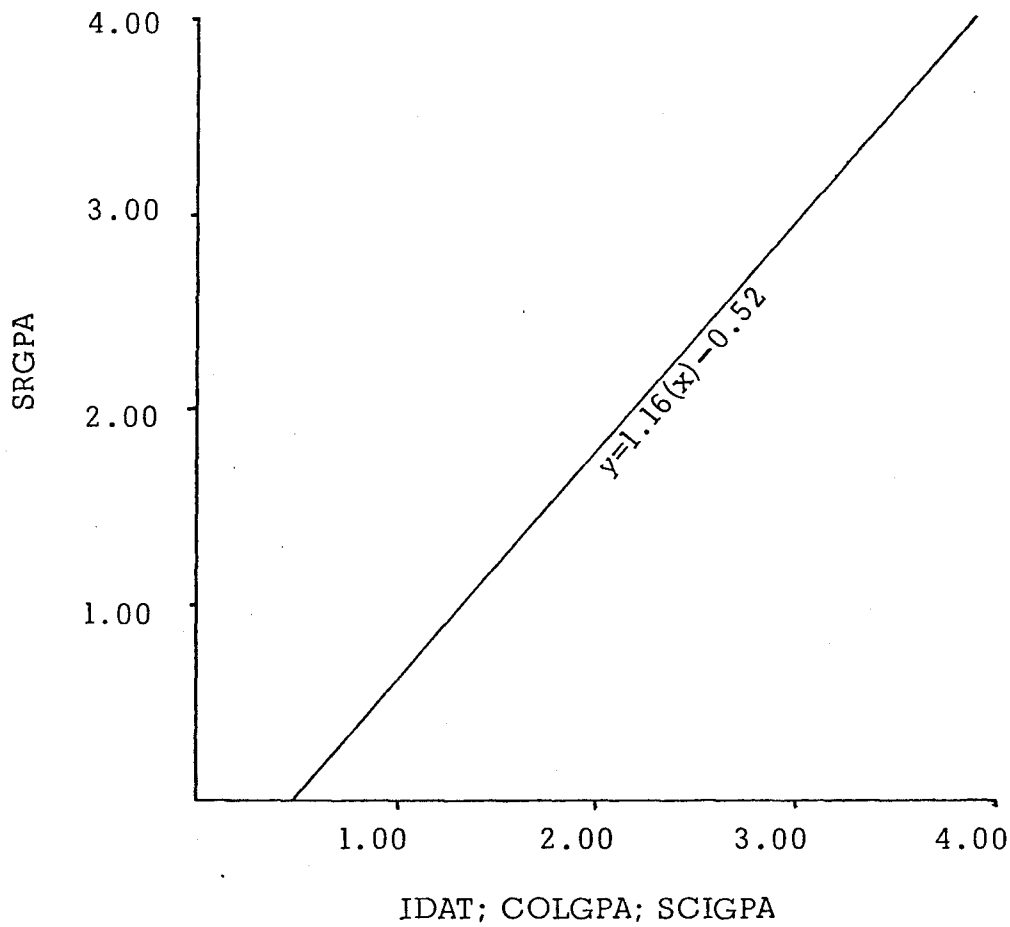


Illustration 4.

FINGPA/IDAT; COLGPA; SCIGPA TABLE 5

$F \geq 1.00$ (F= 2.32)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.35	(.01)	0.35
VERBAL	4.60	1.75	-0.11		0.38
DEPENDENT					
FINGPA	2.84	0.24			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

CARVDX, COLGPA, RDCOMP, FACTKN, TOTSCI, SCIAPP, QUANTR, MENTAL, MANUAL, ACADAV, SPACER, CHEMKN, BIOLKN

TOTAL MULTIPLE R = 0.44

SSx= 1.03

PREDICTOR EQUATION LINE = Y = 0.92(x) = 0.23

FINGPA / IDAT; COLGPA; SCIGPA

(Final Grade Point Average/Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

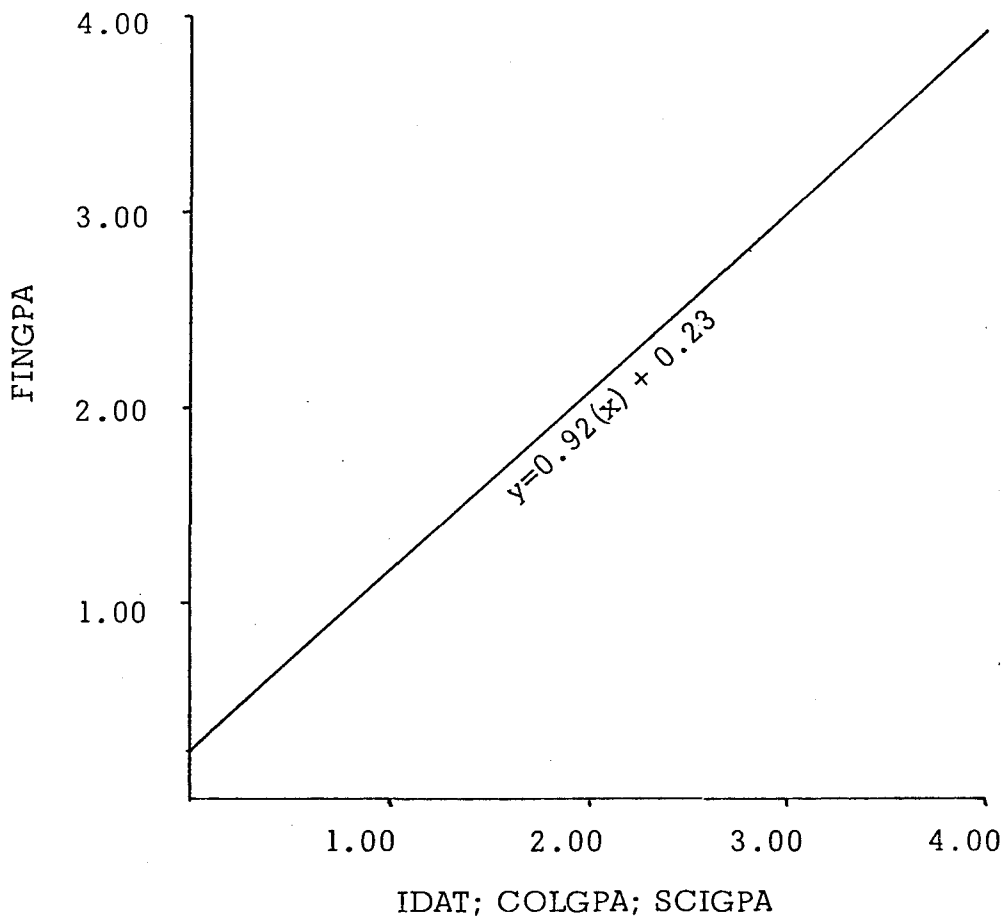


Illustration 5.

FRGPA/SDAT; COLGPA; SCIGPA TABLE 6

$F \geq 1.00$ (F = 1.05)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.41	(.01)	0.41
RDCOMP	4.05	1.68	0.32	(.01)	0.49
CARVDX	4.60	1.53	0.09		0.50
TOTSCI	4.93	1.55	0.26	(.01)	0.52
SCIAPP	4.59	1.60	0.20	(.05)	0.54
FACTKN	4.78	1.39	0.18	(.05)	0.54
DEPENDENT					
FRGPA	2.68	0.35			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

COLGPA, BIOLKN, SPACER, MANUAL, CHEMKN, ACADAV, MENTAL QUANTR, VERBAL

TOTAL MULTIPLE R = 0.56

SSx = 3.32

PREDICTOR EQUATION LINE = Y = 1.08(x) - 0.21

FRGPA / SDAT; COLGPA; SCIGPA

(Freshman Grade Point Average/Senior Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

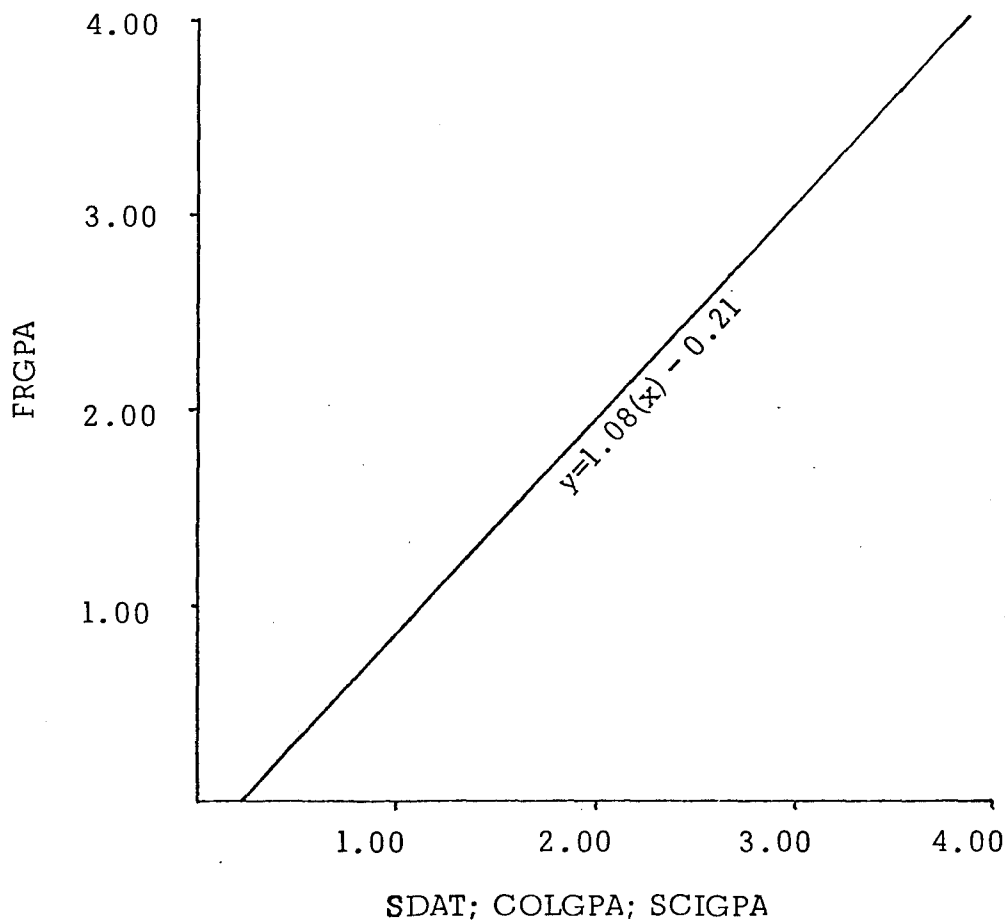


Illustration 6.

SOGPA/SDAT; COLGPA; SCIGPA TABLE 7

$F \geq 1.00$ (F = 1.24)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.29	(.01)	0.29
BIOLKN	6.00	1.61	0.21	(.05)	0.35
CARVDX	4.60	1.53	0.07		0.37
RDCOMP	4.05	1.68	0.19	(.05)	0.38
DEPENDENT					
SOGPA	2.46	0.34			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

QUANTR, SCIAPP, TOTSCI, CHEMKN, SPACER, MANUAL, VERBAL
FACTKN, MENTAL, COLGPA, ACADAV

TOTAL MULTIPLE R = 0.47

SSx = 2.39

PREDICTOR EQUATION LINE = Y = 0.86(x) + 0.34

SOGPA / SDAT; COLGPA; SCIGPA

(Sophomore Grade Point Average/Senior Grade Point Average;
College Grade Point Average;
Science Grade Point Average)

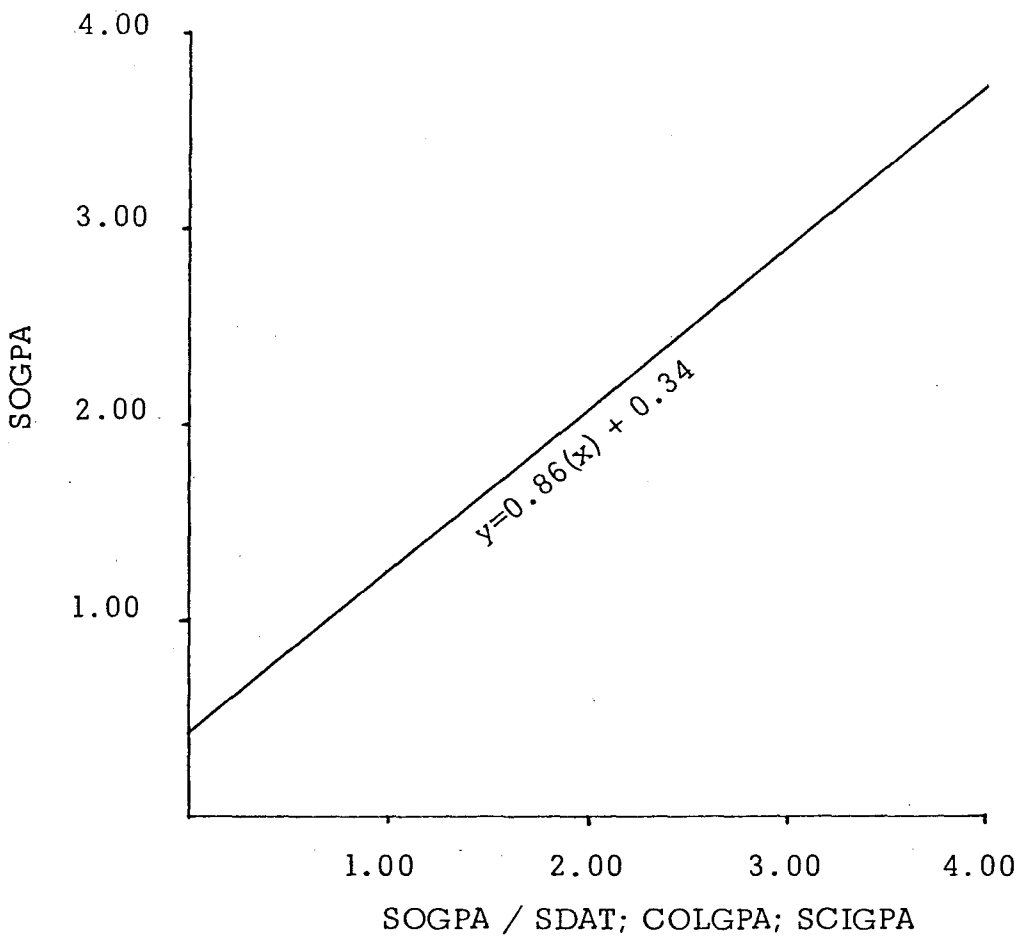


Illustration 7.

JRGPA/SDAT; COLGPA; SCIGPA TABLE 8

$F \geq 1.00$ (F = 2.07)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.20	(.05)	0.20
CARVDX	4.60	1.53	0.18	(.05)	0.28
SPACER	4.50	1.53	-0.13		0.31
COLGPA	2.46	0.24	0.18	(.05)	0.32
RDCOMP	4.05	1.68	0.09		0.34
VERBAL	4.58	1.55	-0.15		0.37
DEPENDENT					
JRGPA	2.90	0.27			

$F < 1.00$ (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

ACADAV, SCIAPP, BIOLKN, TOTSCI, CHEMKN, QUANTR, FACTKN, MANUAL, MENTAL

TOTAL MULTIPLE R = 0.45

SSx = 1.50

PREDICTOR EQUATION LINE = Y = 0.84(x) + 0.46

JRGPA / SDAT; COLGPA; SCIGPA

(Junior Grade Point Average/Senior Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

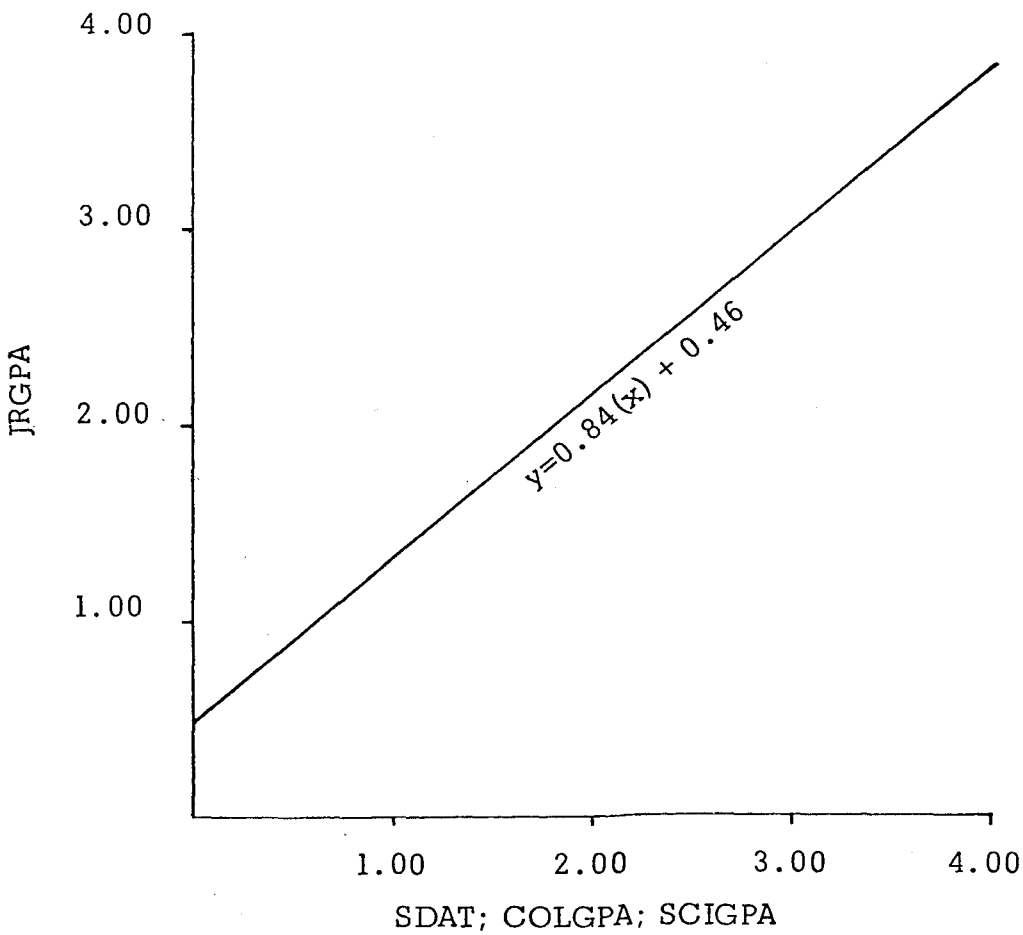


Illustration 8.

SRGPA/SDAT; COLGPA; SCIGPA TABLE 9 F ≥ 1.00 (F= 3.26)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
CARVDX	4.60	1.53	0.22	(.05)	0.22
COLGPA	2.46	0.24	0.15		0.28
SPACER	4.50	1.53	-0.13		0.32
RDCOMP	4.05	1.68	0.06		0.34
VERBAL	4.58	1.55	-0.16		0.36
FACTKN	4.78	1.39	-0.14		0.38
TOTSCI	4.93	1.55	-0.04		0.41
SCIAPP	4.59	1.60	-0.03		0.43
BIOLKN	6.00	1.61	-0.11		0.45
CHEMKN	3.50	1.56	-0.06		0.48
ACADAV	4.31	1.04	-0.03		0.49
QUANTR	3.32	1.51	0.00		0.52
DEPENDENT					
SRGPA	3.26	0.28			

F < 1.00 (LISTED IN DECREASING ORDER OF INDIVIDUAL F) MANUAL, SCIGPA, MENTAL
TOTAL MULTIPLE R = 0.52 SSx = 2.66 PREDICTOR EQUATION LINE = Y = 0.91(x) + 0.29

SRGPA / SDAT; COLGPA; SCIGPA

(Senior Grade Point Average/Senior Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

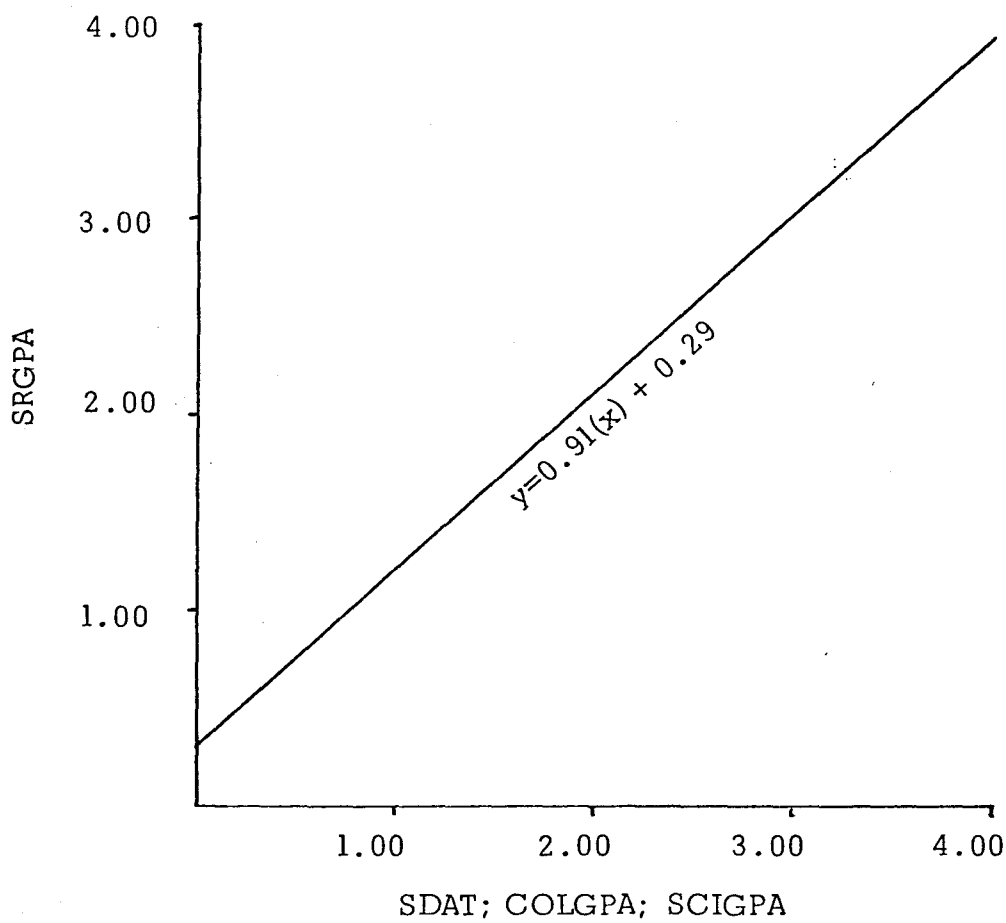


Illustration 9.

FINGPA/SDAT; COLGPA; SCIGPA TABLE 10

F≥1.00 (F 1.40)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.27	0.35	(.01)	0.35
CARVDX	4.60	1.53	0.17	(.05)	0.39
RDCOMP	4.05	1.68	0.22	(.05)	0.43
VERBAL	4.58	1.55	-0.08		0.45
COLGPA	2.46	0.24	0.25	(.01)	0.46
ACADAV	4.31	1.04	0.16		0.47
SPACER	4.50	1.53	-0.07		0.48
MANUAL	4.74	1.19	0.09		0.49
DEPENDENT					
FINGPA	2.84	0.24			

F<1.00 (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

SCIAPP, TOTSCI, FACTKN, BIOLKN, CHEMKN, QUANTR, MENTAL

TOTAL MULTIPLE R = 0.55

SSx = 1.75

PREDICTOR EQUATION LINE = Y = 0.93(x) + 0.20

FINGPA / SDAT; COLGPA; SCIGPA

(Final Grade Point Average/Senior Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

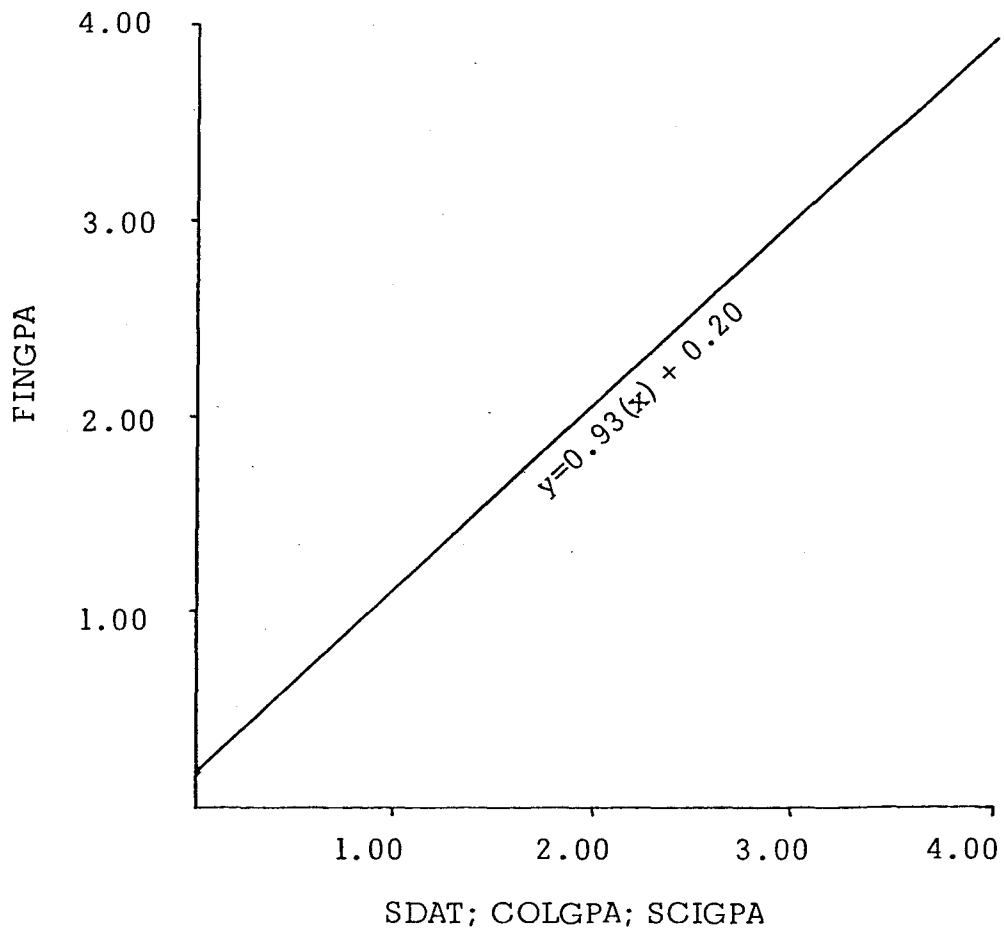


Illustration 10.

NATLBD/IDAT; COLGPA; SCIGPA TABLE 11

$F \geq 1.00$ (F = 1.14)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
SCIGPA	2.41	0.28	0.34	(.01)	0.34
RDCOMP	4.78	1.49	0.29	(.01)	0.45
SCIAPP	4.75	1.54	0.27	(.01)	0.48
VERBAL	4.60	1.73	0.23	(.01)	0.49
DEPENDENT					
NATLBD	85.48	3.40			

$F < 1.00$ (LISTED IN DECREASING ORDER OF INDIVIDUAL F)

COLGPA, BIOLKN, FACTKN, CHEMKN, CARVDX, ACADAV, QUANTR, TOTSCI, MANUAL, SPACER, MENTAL

TOTAL MULTIPLE R = 0.52

SSx = 327.17

PREDICTOR EQUATION LINE = Y = 0.95(x) + 4.27

NATLBD / IDAT; COLGPA; SCIGPA

(National Board Examination/Initial Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

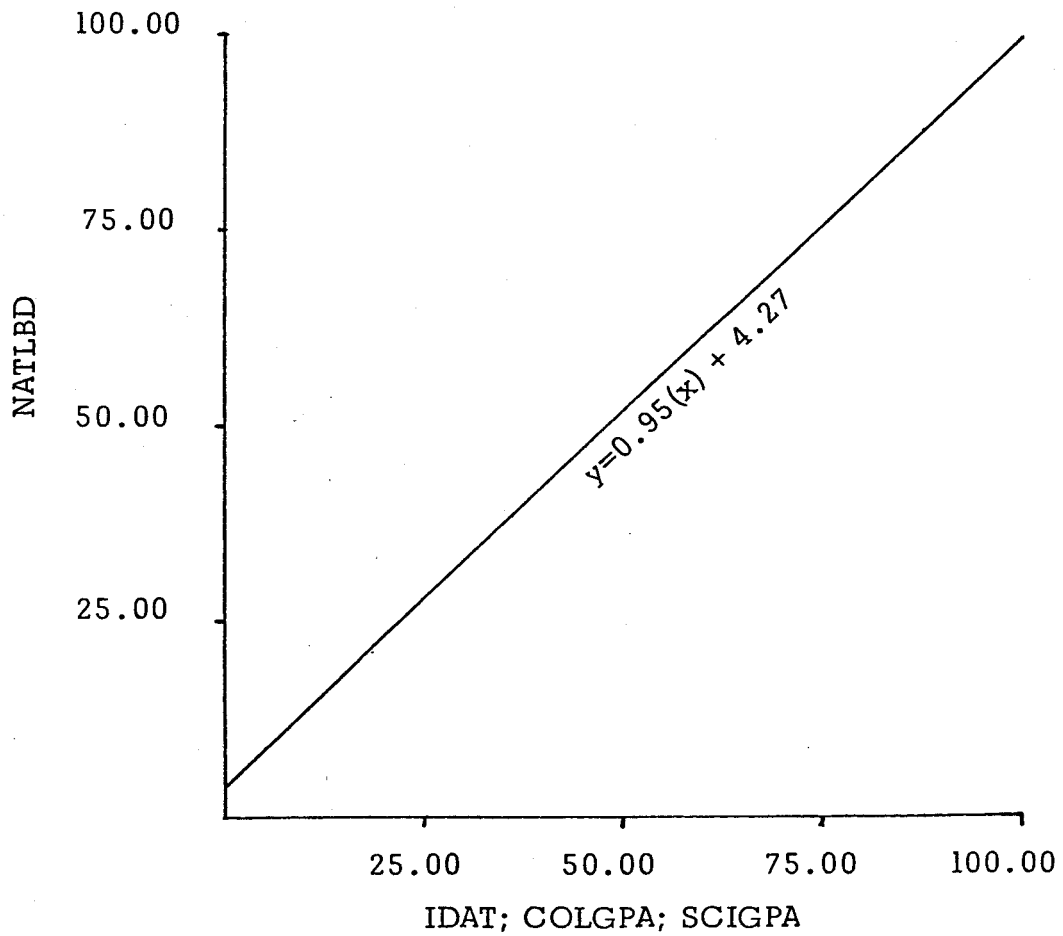


Illustration 11.

NATLBD/SDAT; COLGPA; SCIGPA TABLE 12

F≥1.00 (F = 2.78)

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
TOTSCI	4.93	1.55	0.50	(.01)	0.50
SCIGPA	2.41	0.27	0.34	(.01)	0.57
RDCOMP	4.05	1.68	0.41	(.01)	0.60
CARVDX	4.60	1.53	0.07		0.62
BIOLKN	6.00	1.61	0.45	(.01)	0.64
SCIAPP	4.59	1.60	0.42	(.01)	0.65
VERBAL	4.58	1.55	0.25	(.01)	0.66
DEPENDENT					
NATLBD	85.48	3.40			

F<1.00 (LISTED IN ORDER OF DECREASING INDIVIDUAL F)

COLGPA, QUANTR, SPACER, MANUAL, CHEMKN, FACTKN, ACADAV, MENTAL

TOTAL MULTIPLE R = 0.68 SSx = 557.29

PREDICTOR EQUATION LINE = Y = 0.98(x) + 1.71

NATLBD / SDAT; COLGPA; SCIGPA

(National Board Examination/Senior Dental Aptitude Test;
College Grade Point Average;
Science Grade Point Average)

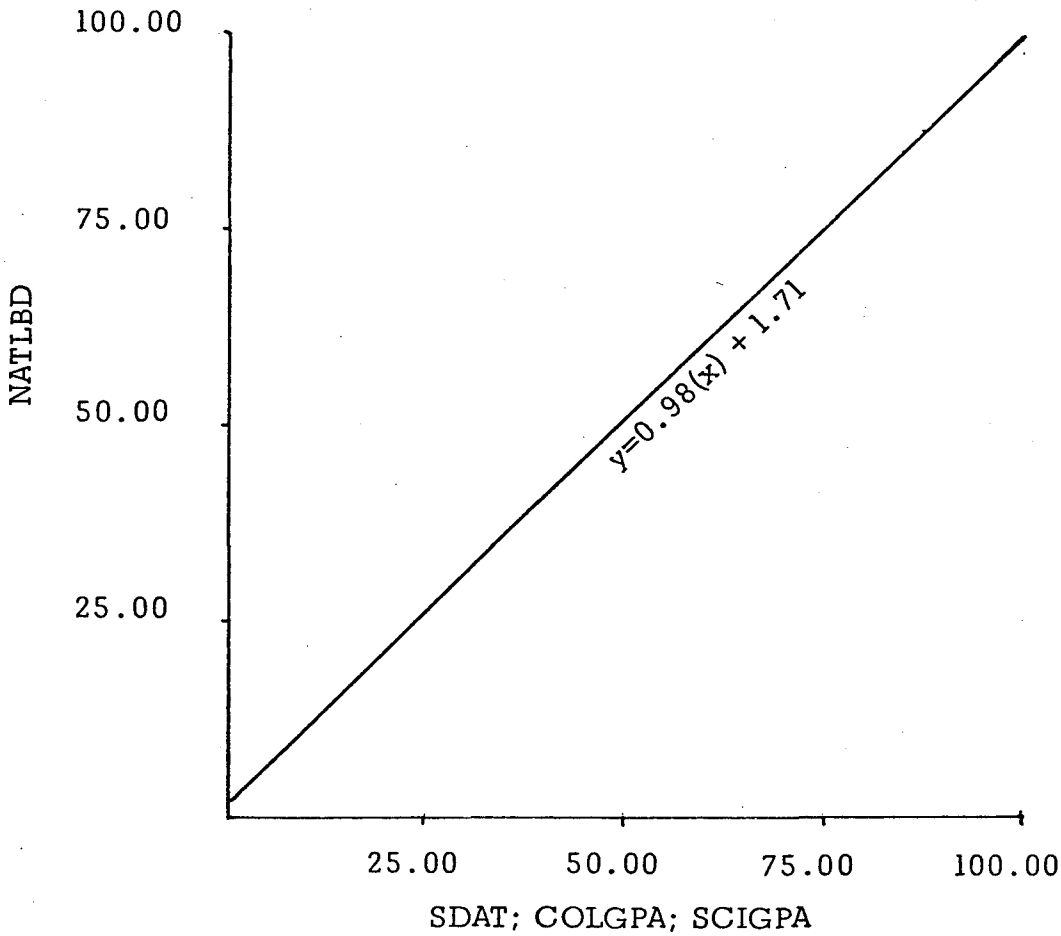


Illustration 12.

NATLBD/FINGPA TABLE 13

F = 44.67

VARIABLE	MEAN	STANDARD DEVIATION	CORRELATION COEFFICIENT	(SIGNIFICANCE)	MULTIPLE R
FINGPA	2.84	0.24	0.55	(.01)	0.55
DEPENDENT					
NATLBD	85.48	3.40			

SSx = 366.08

PREDICTOR EQUATION LINE = Y = X

NATLBD / FINGPA

(National Board Examination/Final Grade Point Average)

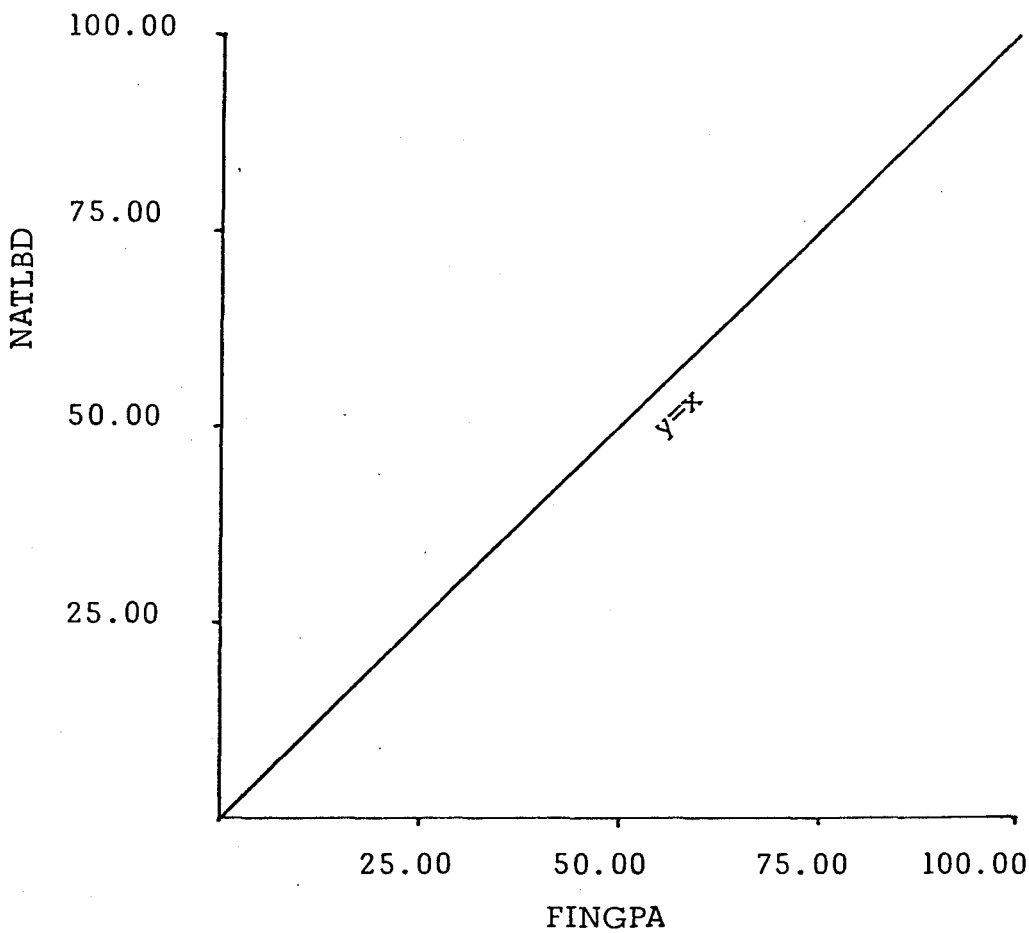


Illustration 13.

DISCUSSION

IDAT; COLGPA; SCIGPA (TABLES AND ILLUSTRATIONS 1-5)

Data derived from the initial testing of the DAT battery revealed undergraduate SCIGPA was the most powerful and consistent predictor of dental school GPA. The SCIGPA was regularly significant with correlation coefficients embracing the 0.01 and 0.05 levels all but once for each grading year (Tables 1-5). The final GPA was predicted by SCIGPA to the 0.01 level of significance, and the sophomore year GPA (Table 2) factored out only SCIGPA as the best predictor.

The freshman and sophomore individual GPAs factored out very selective predictors (Tables 1 and 2) while in the junior and senior years more variables added to the predictive foreplay (Tables 3 and 4). However, the final GPA against IDAT; COLGPA; and SCIGPA only rendered SCIGPA and VERBAL as valid predictors (Table 5). This shift between the sophomore and junior years most likely represented the reorientation from primarily academic in the first two years to the heavy clinical weight for grades in the latter years. This shift was also illustrated by a change in prediction line slopes (Illustrations 1-5).

Of note was the placement of the predictive weight

given to the manual components of the DAT battery. The CARVDX emerges with significance only in the latter part of the four year grading history again depicting the shift from academic preponderance to clinical endeavors (Tables 3 and 4).

SDAT; COLGPA; SCIGPA (TABLES AND ILLUSTRATIONS 6 - 10)

Retesting of the DAT consistently produced more predictive factors than those against IDAT; COLGPA; and SCIGPA. The SCIGPA again was placed very high as a predictive component with the obvious exception of the senior year (Table 9). The CARVDX was consistently more predictive in the retest.

Of interest was the increased predictive value of reading, linguistic and mental organizational skills in the retest. This perhaps reflects upon individuals who take tests well. The second testing produced more factors at greater significance levels with more nuclear distribution of scatter plots represented by higher multiple R values. Linear equations showed tight grouping of prediction line slopes around the FINGPA/SDAT; COLGPA; SCIGPA average of $Y = 0.93 (X) + 0.20$ (Illustration 10). This was more dramatic than the initial testing correlations.

NATLBD/IDAT; COLGPA; SCIGPA (TABLE AND ILLUSTRATION 11)

All predictors above the $F = 1.00$ cut-off were sig-

nificant at the 0.01 level. Again, SCIGPA emerged as the single best prophesy. Mental endeavors appeared to be the best mediators of prediction for this particular set.

NATLBD/IDAT: COLGPA; SCIGPA (TABLE AND ILLUSTRATION 12)

The retest produced a similar phenomenon as that seen with dental school grade prediction. More variables were predictably load and those at or above F at 1.00 were all significant at the 0.01 level with the exception of CARVDX. Mental manipulation seemed to be more encompassing than with the initial testing.

The multiple R values expressed were the highest yet. This added credence to the linear representation of the coordinate scatter.

NATLBD/FINGPA (TABLE AND ILLUSTRATION 13)

Final GPA with NATLBD scores correlated at the 0.01 level with a multiple R value of 0.55. Evidence of high prediction between NATLBD scores and FINGPA was also mirrored with a linear output of y = x.

The types of decisions that arise from consideration of thest test results are, in the last analysis, in the nature of predictions. If these predictions are not substantiated by later developments to an extent greater than chance would warrarnt one to expect, then for one reason or

another the tests have failed to achieve their purpose. The analysis presented combined tests that can be viewed as achievement and aptitude in orientation. The distinction is not a clear one. The emphasis of the DAT battery is centered around potential and less upon current abilities as with GPA. The latter represents achievement testing because the teacher must evaluate present mastery of the course content. As the student's transcript accompanies him in his professional education, the record of his overall academic achievement is in some way being implemented to make predictions as to his likelihood of success. The DAT battery was an attempt to bridge this gap. However, the current study points to the fact that perhaps SCIGPA is the single most reliable predictive value available for inspection.

The stepwise multiple regression for $F \geq 1.00$ yielded a series of the best predictors for each of the dependent variables. With IDAT; COLGPA; SCIGPA; fifteen predictors were put into the multiple regression analysis. It was shown that nothing is really gained by including more than one or two for the FRGPA, SOGPA and FINGPA (Tables 1, 2, and 5). This trend, although not as dramatic, held true throughout the analysis.

Numerically, prediction values derived from the DAT

battery were not high. But while it seems predictions using the DAT for dental school grades are not outstanding, it does not follow strictly that the test selects students poorly. Perhaps the DAT examination is a better selector than a predictor. Low prediction with the DAT may be due to variable unreliability. It should be noted that all data gathered have been from students already accepted and who have completed four years of dental school.

The current DAT battery has been altered from the one administered in this study. The carving dexterity portion has been eliminated in favor of an expanded spacial perception problem. One argument for the change was the low predictive value of the CARVDX. If technique grades and scores on the carving test are determined solely on the basis of making skillful carvings, one would expect a high degree of correlation between the two. But if grades are determined by the student's ability to make skillful carvings, to memorize textbook materials and impress the professor, while CARVDX scores are determined by the capacity to make skillful carvings with an unfamiliar and dull knife, and to adjust to new surroundings on the day of the test, it becomes apparent that correlation between grades and scores may be lower due to less common-

ality. Grades are based on relevant determinants for that particular course.

Prediction is very hard to assess due to at least two obvious variables: the degree of motivation on the part of the student and the ability to impart knowledge. Therefore, the DAT should not be given undue weight and other information gathering should be broadened and escalated on applicants.

Graphic interpretation of the data enables visualization of coordinates generated as predicted values (X estimate) against the given Y value (Appendix B). Freshman GPA, and to a lesser extent sophomore GPA, plotted against IDAT; COLGPA, SCIGPA had numerical prediction equivalents which reflected a representative student who had scored well by admissions standards but achieved grades less indicative of entrance qualifications. This same student during the junior and senior years produced a typical slope that was more one to one for prediction. Final grade standing was mediated between the first and second two years of dental school. Prediction lines derived from the retest were more tightly grouped and did not identify the shifting evident in the original testing.

Prediction lines for National Board criteria generally approached one to one ratios. Perhaps the reason for

higher correlation with the NATLBD can be discerned from the fact that the National Board examinations for dentistry were developed for reasons separate from the DAT. The National Board was designed so standardized criteria could be applied in order to assess knowledge and comprehension of individual subjects fundamental to dental practice. Therefore, the high correlation between NATLBD and FINGPA is explained.

Arithmetic means are used by the DAT, with the intention being the combined scores are more predictive than those assessed separately. However, the data suggest they do not factor together consistently. Perhaps we are dealing with different universes. From current evidence, perhaps justification of averaging certain scores is tenuous at best.

Future avenues for investigation should be targeted towards developing comprehensive multifactorial screening procedures for admission into dental school. These procedures should encompass numerical, psychological, and physical predictive components to achieve the best possible professional end product. Admissions committees should generate continuous longitudinal data which would serve as ballast for ongoing in-house re-evaluation. These committees would be best surved by individuals who

embodied diverse specialized knowledge of tests and testing protocol on a professional level.

SUMMARY

The multiple regression analysis of data supplied produced a series of best predictors for success in dental school. The single best predictor surfaced as undergraduate science GPA. The SCIGPA did not factor consistently with the overall college GPA, suggesting admissions reviewers fractionize information gained from the undergraduate level. In the light of current grade inflation, this adds the burden of standardizing grade schemes from college to college.

Information redundancy is apparent in the DAT battery. Maximum information may be necessary to rank those best qualified competitively on class rosters, but it is not necessary for the prediction of success in dental school for these candidates.

Since dental schools are evaluated and accredited to a high level by the statistics they produce, students admitted with below average credentials will inordinately skew the final statistics. These special students who are admitted due to a high emotional evaluation should perhaps be subgrouped under a special program. In that way the schools would not suffer against the national average. Evaluations pertaining to the students' success might accordingly be determined after the second year. It is

at this time that graphic prediction analysis indicated a more consistent input in this study.

In conclusion, the undergraduate science grade point average emerged as the best single numerical predictor of success in dental school against a backdrop of several redundant, inconclusive testing variables. Manual appraisal only became predictive after the shift in curriculum emphasis from didactic to clinical sciences.

BIBLIOGRAPHY

American Dental Association, Council on Dental Education: Dental Aptitude Testing Program, 1956, Chicago, American Dental Association, 1955.

Blommers, Paul J.: Prediction of Success in the First and Second Years of the Study of Dentistry on the Basis of Certain Select Variables. Journal of Dental Education 20:5-16, 1956.

Chen, Martin K. and Podshadley, Dale W.: A Factorial Study of some Psychological Vocational Interest and Mental Ability Variables as Predictors of Success in Dental School. Journal of Applied Psychology 51: 236-241, 1967.

Cianflone, Daniel and Zullo, Thomas: Relationship between Dental School Performance and Preprofessional Major Courses of Study. Journal of Dental Education 39:78-81, Feb. 1975.

Derevere, Robert E.: Comparison of Dental Aptitude Tests with Achievement in Operative Dentistry. Journal of Dental Education 25:50-56, 1961.

Durocher, Roy T.: The Admissions Dilemma. Journal of Dental Education 39:645-646, Oct. 1975.

Dworkin, Samuel: Dental Aptitude Test as Performance Predictor over Four Years of Dental School: Analysis and Interpretations. Journal of Dental Education 34:28-38, March 1970.

Dworkin, Samuel: Further Correlation and Factor Analysis of the DAT as a Predictor of Performance: Conclusion and Summary. Journal of Dental Education 34: 358-364, Dec. 1970.

Fernandez-Pabon, Jorge J.: Prediction of Success in Dental School on the Basis of Dental Aptitude Test Scores and other Variables. Journal of Dental Education 32:26-36, March 1968.

Fredericks, Marcel A. and Mundy, Paul: Relations between Social Class, Average Grade in College, Dental Aptitude Test Scores, and Academic Achievement of Dental Students. Journal of Dental Education 32:26-36, March 1968.

Full, Clemens A. and Foley, Walter J.: Selection and Performance: A Factorial Study of Dental Students. Journal of Dental Education 35:563-566, Sept. 1971.

Fuller, James; Killip, Devore, and Kerber, Paul: An Admissions Interview to Measure "Good" Dentist Attributes. Journal of the American Dental Association 98:547-552, April 1979.

Ginley, Thomas J.: Present Status and Future Plans of the Dental Aptitude Testing Program. Journal of Dental Education 30:163-174, 1966.

Graham, James: Substitution of Perceptual-Motor Ability Test for Chalk Carving in the Dental Admissions Testing Program. Journal of Dental Education 36: 9-14, Nov. 1972.

Heller, D. Brian; Carson, Lawrence, and Douglas, Bruce: Selection of Students for Dental School. Journal of Dental Education 29:202-207, June 1965.

Hood, Albert B.: Predicting Achievement in Dental School. Journal of Dental Education 27:148-155, June 1963.

Houston, J.B. and Mensh, I.: Multiple Regression of Predictors and Criteria of Dental School Performance. Journal of Dental Research 54:515-521, 1975.

Hutton, H.G., Jr.: Aptitude and Personality Correlates of Dental School Performance. Journal of Dental Education 33:474-486, 1969.

Jacobs, R.M.; Maxey, E.J.; and Kreit, L.H.: Five-year Study of Predental and Premedical Students at University of Iowa. Journal of Dental Education 37:44-51, Jan. 1973.

Kreit, L.H. and McDonald, R.E.: Preprofessional Grades and the Dental Aptitude Test as Predictors of Student Performance in Dental School. Journal of Dental Education 32:452-457, Dec. 1968.

Manhold, J.H. and Manhold, B.S.: Final Report of an Eight-year Study of the Efficacy of the Dental Aptitude Test in Predicting Four-year Performance in a New Dental School. Journal of Dental Education 20:41-45, March 1965.

Manhold, J.H. and Manhold, B.S.: Predictive Value for Four-year Performance of Individual Parts of the Dental Aptitude Test. Journal of Dental Education 31:62-65, Jan. 1967.

McGrath, Earl J.: Predictive Value of Grades in Various Predental Courses. Journal of Dental Education 7:46-55, 1942.

Peterson, Shailer: Forecasting the Success of Freshman Dental Students through the Aptitude Testing Program. Journal of the American Dental Association 37:259-265, Sept. 1948.

Peterson, Shailer: The ADA Chalk Carving Test. Journal of Dental Education 38:11-15, Jan. 1974.

Phillips, P.J. and Reitz, William: Statistical Models for the Selection of Applicants for the DDS Program. Journal of Dental Education 35:150-158, March 1971.

Phipps, Grant T.; Fishman, Ross, and Scott, Russell H.: Prediction of Success in a Dental School. Journal of Dental Education 32:161-170, June 1968.

Podshadley, D.W.; Chen, M.K., and Shrock, J.G.: A Factor Analytic Approach to the Prediction of Student Performance. Journal of Dental Education 33: 105-111, 1969.

Ross, Norton W.: Dental Aptitude Test Results of Success in Dental School on the Basis of Dental Aptitude Test Scores and other Variables. Journal of Dental Education 31:84-88, Jan. 1967.

Ship, Irwin I. and Laster, Larry L.: Aptitude and Achievement in Dental Education. Journal of Dental Education 31:44-57, 1967.

Smith, Ray V.: Aptitudes and Aptitude Testing in Dentistry. Journal of Dental Education 8:55-70, 1943.

Smith, Timothy A. and Hill, Gerald W.: Correlation of Performance in Basic Sciences in Dental School with Predental Science Experiences. Journal of Dental Education 36:37-40, Sept. 1972.

Travers, Robert and Wallace, Wallace L.: Inconsistency in the Predictive Value of a Battery of Tests. Journal of Applied Psychology 34:237-239, 1950.

Trocchini, John J.; Eudey, Mark W.; Thomassen, Paul R., and Reinke, Benjamin C.: Correlation Study between Aptitude Testing and Dental Student Performance. Journal of Dental Education 25:269-273, 1961.

Webb, Sam C.: Evaluating Tests as Predictor of Dental School Grades. Journal of Dental Education 22: 33-45, 1958.

Weis, Irving: Prediction of Academic Success in Dental School. Journal of Applied Psychology 36:11-14, 1952.

Yates, Thomas R. "Dental Students: A Study of Personality and Attitudes at two Dental Schools." Unpublished Thesis. University of Illinois, 1976.

Zullo, Thomas G.: A Factor Analysis of Perceptual and Motor Abilities of Dental Students. Journal of Dental Education 35:356-361, 1971.

Zullo, Thomas G.: Principal Component Analysis of the Dental Aptitude Test Battery. Journal of Dental Education 35:144-148, 1971.

APPENDIX A

ACTUAL DATA OUTPUT

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
1	2.81	3.32	2.88	2.60	2.36	76	F	F	2.15	2.19
2	3.07	3.44	3.01	2.91	2.91	89			2.33	2.32
3	3.42	3.75	3.19	3.28	3.47	89			3.08	3.37
4	3.15	3.41	2.90	2.91	3.44	90			2.39	2.56
5	3.09	3.03	3.07	3.05	3.22	91			2.50	2.88
6	3.03	3.56	3.11	2.57	2.84	86			2.22	2.09
7	2.48	2.89	2.78	2.00	2.19	82			2.41	2.17
8	2.80	3.26	2.92	2.48	2.49	86			2.34	2.25
9	2.87	3.38	2.76	2.69	2.64	85			2.31	2.12
10	2.84	3.21	2.72	2.52	2.92	88			2.60	2.29
11	2.97	3.09	2.86	2.82	3.12	93			2.26	2.46
12	3.04	3.31	3.13	2.65	3.06	89			2.51	2.38
13	2.62	3.35	2.84	1.93	2.29	80			2.48	2.25
14	2.88	3.65	3.09	2.29	2.40	80			2.45	2.45

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
15	3.19	3.21	3.11	2.95	3.53	88			2.59	2.61
16	2.58	3.25	2.80	2.12	2.05	83			2.40	2.13
17	2.58	2.93	2.80	2.21	2.34	85			2.38	2.36
18	2.82	3.29	3.03	2.31	2.60	83			2.41	2.37
19	2.66	2.93	2.74	2.29	2.66	87			2.23	2.67
20	2.53	2.89	2.78	2.12	2.28	87			2.34	2.12
21	2.77	3.17	2.82	2.60	2.46	84			2.36	2.56
22	2.96	3.50	3.13	2.59	2.56	84			2.37	2.32
23	3.01	3.46	3.17	2.75	2.58	88			2.10	2.25
24	2.38	2.61	2.47	2.02	2.42	78		F	2.14	2.10
25	2.82	2.97	2.88	2.55	2.89	86			2.36	2.20
26	2.65	3.14	2.68	2.17	2.59	86			2.26	2.26
27	2.55	3.09	2.62	2.17	2.27	85			2.71	2.42
28	2.72	3.40	3.00	2.07	2.32	80	F		2.18	2.31
29	2.82	3.77	2.96	2.03	2.48	82			2.50	2.42

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
30	2.94	3.45	3.07	2.38	2.79	80			2.01	2.17
31	2.88	3.17	3.19	2.58	2.52	86			2.52	2.46
32	2.92	3.53	2.86	2.43	2.84	88			2.52	2.19
33	2.75	3.17	2.90	2.29	2.62	88			2.31	2.57
34	2.64	3.13	2.82	2.35	2.19	89			2.40	2.11
35	3.10	3.43	3.29	2.70	2.91	87			2.67	2.33
36	2.90	3.28	3.13	2.75	2.36	89			2.34	2.41
37	3.31	3.75	3.52	2.96	2.93	86			2.52	2.13
38	2.64	3.34	2.70	2.20	2.28	83			2.39	2.42
39	3.08	3.52	3.13	2.77	2.86	87			2.65	2.75
40	2.76	3.42	2.94	2.15	2.45	85			2.70	2.51
41	2.65	3.11	2.72	2.28	2.45	90			2.36	2.51
42	3.21	3.63	3.23	2.78	3.18	88			3.00	2.90
43	3.33	3.80	3.37	2.86	3.47	92			2.19	2.13
44	2.83	3.22	2.72	2.46	2.92	91			2.48	2.42

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
45	2.77	3.00	2.94	2.34	2.78	86			2.08	2.05
46	2.98	3.43	3.03	2.60	2.81	81			2.41	2.10
47	2.87	3.01	2.82	2.83	2.85	85			2.24	2.23
48	2.58	2.88	2.78	2.10	2.53	86			2.32	2.38
49	2.67	3.09	2.80	2.32	2.41	88			2.77	2.50
50	3.48	3.81	3.49	3.33	3.26	92			2.75	2.40
51	2.60	2.96	2.82	2.24	2.33	87			2.71	2.55
52	2.55	2.94	2.62	2.21	2.41	84			3.05	2.82
53	2.97	3.50	3.19	2.47	2.65	91			2.43	2.67
54	2.57	3.22	2.98	2.00	2.00	84			2.39	2.54
55	3.14	3.41	3.05	2.98	3.09	87			2.91	2.66
56	3.23	3.77	3.19	2.89	3.02	90			2.40	2.73
57	2.62	2.77	2.21	2.70	2.86	82			2.06	2.08
58	2.86	3.57	3.03	2.17	2.59	82	F		2.64	2.66
59	2.75	3.39	2.92	2.20	2.45	81			2.32	2.46

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
60	2.82	3.50	3.03	2.13	2.55	84			2.77	2.65
61	2.69	3.11	2.68	2.29	2.67	82			2.29	2.40
62	2.61	3.27	2.52	2.02	2.61	89			2.61	2.27
63	2.75	3.22	2.34	2.23	2.55	84			2.31	84
64	2.59	3.14	2.72	2.05	2.40	84			2.33	2.31
65	2.76	3.06	2.74	2.40	2.58	84			2.37	2.32
66	2.77	3.23	3.00	2.26	2.54	84			2.52	2.07
67	2.92	3.14	2.96	2.67	2.89	85			2.43	2.57
68	2.35	2.91	2.43	2.04	1.98	81			2.53	2.08
69	2.65	3.30	2.92	2.08	2.21	82			2.23	2.19
70	3.06	3.22	3.13	2.60	3.29	87			2.39	2.28
71	2.83	2.88	2.62	2.57	3.29	88			2.78	2.81
72	2.58	3.02	2.76	2.26	2.20	87			2.16	2.32
73	2.77	3.23	2.82	2.21	2.79	82			2.42	2.37
74	3.13	3.57	3.27	2.61	3.04	91			2.40	2.41

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
75	2.53	2.91	2.70	1.94	2.54	83			2.51	2.41
76	2.84	3.08	2.90	2.38	2.98	86			2.51	2.85
77	2.82	2.97	2.94	2.43	2.94	87			2.49	2.45
78	2.81	3.01	2.88	2.25	3.09	89			2.65	2.39
79	2.54	2.96	2.21	2.21	2.25	86			2.79	2.70
80	2.58	2.57	2.31	2.88	2.69	82			2.51	2.47
81	2.62	2.84	2.13	3.15	2.32	81			2.60	2.32
82	2.52	2.85	2.80	2.11	2.26	81			2.53	2.25
83	2.44	2.92	2.68	1.97	2.09	77	F	F	2.26	2.23
84	2.58	2.92	2.62	2.07	2.68	86			2.78	2.20
85	2.76	3.18	3.00	2.22	2.58	86			2.39	2.24
86	3.21	3.30	3.27	2.92	3.33	91			2.51	3.13
87	3.41	3.89	3.37	3.31	3.02	90			2.69	2.60
88	2.68	3.42	2.76	2.08	2.41	84			2.00	2.13
89	2.95	3.41	3.01	2.67	2.67	80		F	2.75	2.43

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I	FAIL II	COL. GPA	SCI. GPA
90	2.95	3.37	3.01	2.21	3.20	88			3.29	3.60
91	2.94	3.32	3.09	2.50	2.78	84			2.76	2.00
92	2.68	3.19	2.86	2.24	2.35	84			2.19	2.12
93	3.20	3.67	3.29	2.80	2.99	87			2.14	2.36
94	3.30	3.90	3.35	3.01	2.89	88			2.81	2.40
95	2.71	3.19	3.09	2.23	2.24	84			2.75	2.51
96	2.84	3.67	2.90	2.16	2.59	85			2.08	2.21
97	2.76	3.15	2.80	2.33	2.74	86			2.18	2.05
98	2.76	2.98	2.82	2.61	2.69	87			2.09	2.35
99	2.56	3.23	2.50	2.08	2.39	84			2.19	2.11
100	3.21	3.50	3.25	2.93	3.16	87			2.63	2.68
101	3.21	3.44	3.29	2.85	3.24	90			2.45	2.38
102	2.83	3.51	2.96	2.24	2.56	81			2.33	2.23
103	3.02	3.55	3.13	2.46	2.89	84			2.69	2.63
104	2.69	3.25	2.82	2.21	2.44	84			2.33	2.35

OBS. NO.	FI. GPA	SR. GPA	JR. GPA	SO. GPA	FR. GPA	NATLBD. AVE.	FAIL I II	COL. GPA	SCI. GPA
105	3.00	3.48	3.05	2.62	2.80	86		2.54	2.67
106	3.01	3.37	3.11	2.26	2.89	85		2.82	2.66
107	2.76	3.10	2.21	2.90	2.71	84		2.27	2.59

OBS. NO.	INITIAL DAT SCORES													SENIOR DAT SCORES											
1	4	6	6	4	5	3	3	5	5	4	5	6	6	4	6	5	2	3	2	8	3	4	7	6	7	5
2	4	6	4	4	4	4	4	4	5	3	4	5	6	3	5	2	3	2	2	8	2	5	4	5	4	5
3	3	5	5	2	4	4	0	4	2	3	2	4	5	5	4	5	3	4	5	8	3	4	6	6	3	5
4	5	6	2	5	3	6	5	5	6	5	6	5	7	4	7	2	5	3	3	6	4	6	4	5	5	8
5	6	4	9	5	7	4	5	5	6	4	5	4	4	5	5	6	3	5	4	9	4	6	7	7	4	5
6	4	7	3	4	4	5	2	6	2	5	4	6	8	4	6	4	4	4	6	4	4	4	3	4	6	5
7	5	6	3	5	4	6	5	5	5	5	5	5	7	3	5	4	6	5	1	5	0	2	2	2	5	5
8	5	4	8	5	6	4	4	6	4	6	5	2	6	6	4	4	4	4	5	8	7	8	6	8	3	5
9	5	6	4	5	4	5	5	4	5	3	4	3	8	4	4	1	4	2	3	7	4	6	5	6	3	5
10	4	7	4	5	4	2	6	6	6	6	6	7	6	4	7	3	4	4	4	7	3	5	5	5	9	4
11	7	7	4	8	6	8	7	8	7	9	8	7	6	7	7	4	8	7	9	8	6	7	8	8	8	5
12	5	6	3	4	3	6	6	4	5	5	5	6	5	4	5	1	4	2	5	7	4	6	5	6	6	4
13	3	7	4	4	4	2	3	4	5	3	4	4	9	3	4	3	4	3	5	4	0	2	3	2	3	4
14	5	6	6	4	5	6	4	4	3	5	4	5	6	5	5	5	6	6	5	4	3	4	4	4	5	5
15	5	8	5	3	4	4	7	6	6	8	7	6	9	5	5	5	6	5	5	6	4	5	5	6	5	5
16	4	5	0	5	2	6	4	4	4	4	4	4	6	4	5	4	5	5	5	5	3	4	4	4	5	5
17	6	5	6	7	7	6	7	4	5	6	6	5	5	6	5	5	7	6	4	8	4	6	6	6	4	5
18	3	4	4	1	2	3	5	4	5	4	5	4	3	4	4	2	3	2	3	7	3	4	6	5	2	5
19	4	5	5	4	5	3	5	4	5	4	4	4	5	4	4	4	4	4	3	6	4	4	5	5	3	5
20	6	5	6	6	6	6	6	6	7	6	7	5	5	5	6	3	5	4	3	9	5	7	6	7	7	4
21	5	4	4	6	5	5	4	4	6	2	4	4	4	4	6	4	3	2	3	6	3	4	5	5	4	7
22	4	7	3	2	3	5	6	5	6	5	6	5	9	4	4	2	6	4	2	6	4	5	4	5	5	3

OBS. NO.	INITIAL DAT SCORES													SENIOR DAT SCORES											
23	4	7	1	4	3	4	7	6	8	5	7	5	9	5	7	4	7	6	5	8	3	5	6	6	8
24	3	5	3	2	2	3	4	2	4	2	3	4	6	3	5	3	2	2	3	4	2	4	2	3	4	6
25	4	4	5	6	6	3	3	2	3	2	2	2	6	4	4	5	6	6	3	3	2	3	2	2	2	6
26	6	5	4	6	5	5	8	5	5	7	7	6	4	5	7	4	7	6	5	8	3	5	6	6	6	8
27	5	5	4	5	5	3	5	8	7	7	7	5	5	5	5	4	5	5	3	9	3	6	6	6	5	4
28	4	4	4	5	5	5	4	3	3	3	3	4	4	4	3	4	3	3	3	5	3	4	4	4	4	2
29	5	5	5	2	3	6	4	4	4	3	4	6	4	4	5	5	2	3	6	4	4	4	3	4	6	4
30	4	7	2	2	2	4	5	5	4	6	5	4	9	4	7	3	2	3	6	4	3	4	3	3	4	9
31	4	7	6	4	5	4	6	2	4	4	4	4	9	3	4	2	4	3	1	6	0	4	2	3	4	3
32	5	5	4	6	5	5	5	3	3	5	4	4	5	4	5	3	5	4	3	6	3	4	5	5	5	5
33	4	5	0	4	1	6	7	5	5	6	6	4	5	3	5	1	3	1	4	7	2	5	3	5	5	5
34	5	5	5	4	4	4	5	7	6	6	6	5	4	4	6	3	5	4	2	8	4	6	6	6	6	5
35	6	4	3	6	4	7	9	3	5	7	6	4	4	5	3	4	6	5	6	6	3	6	3	5	3	3
36	5	4	7	5	6	4	3	6	2	7	5	4	4	5	3	6	5	6	5	5	4	5	4	5	3	3
37	4	7	4	2	3	4	4	4	4	5	3	4	9	4	7	4	2	3	4	4	4	5	3	4	5	9
38	4	4	4	3	3	4	5	4	5	5	5	4	3	3	4	4	3	3	2	6	2	3	4	4	3	5
39	3	8	3	2	3	5	2	4	3	3	3	6	9	2	7	4	3	3	2	2	0	1	1	1	6	7
40	5	6	6	4	5	3	5	5	6	5	6	5	7	4	5	5	5	5	3	5	4	6	4	5	4	5
41	6	8	3	6	5	9	6	6	6	6	6	9	7	5	5	1	4	2	7	8	6	8	7	8	6	4
42	6	4	6	4	5	7	8	6	7	8	8	4	6	4	6	5	6	5	1	5	5	4	6	6	6	5
43	6	6	8	6	7	5	5	6	5	6	6	6	6	6	6	4	7	6	6	7	5	6	6	7	6	5
44	5	4	4	6	5	5	5	3	4	4	3	5	3	5	4	1	4	3	7	8	3	4	6	6	4	4

OBS. NO.	INITIAL DAT SCORES													SENIOR DAT SCORES											
45	6	5	5	9	8	5	6	3	5	4	5	6	4	6	5	4	8	8	5	8	4	6	6	6	7	3
46	4	4	3	3	3	4	4	4	4	5	4	2	5	4	4	3	3	3	4	4	4	4	5	4	2	5
47	6	4	6	3	5	6	8	7	9	6	8	4	4	6	4	6	3	5	6	8	7	9	6	8	4	4
48	4	5	6	4	5	7	3	4	3	4	4	4	4	5	4	1	4	2	6	8	6	7	7	7	4	3
49	4	3	3	4	4	2	5	4	4	4	4	3	3	4	4	2	5	4	6	7	1	4	4	4	3	5
50	4	5	6	4	5	5	3	3	2	3	3	4	6	5	5	4	3	4	4	7	5	5	6	6	4	5
51	6	5	4	7	6	6	6	5	5	7	6	5	5	6	5	5	6	6	4	8	7	8	7	8	6	3
52	6	6	8	7	8	5	5	5	5	5	5	9	2	5	5	7	6	7	3	6	5	5	5	6	6	4
53	4	5	4	3	4	6	5	4	2	5	4	4	6	5	6	3	4	3	6	7	5	6	7	7	4	7
54	4	5	4	4	4	3	3	6	5	4	4	3	6	4	3	3	4	4	3	5	3	4	4	4	3	3
55	6	3	9	6	7	5	4	5	4	5	4	4	2	5	3	7	5	6	2	6	3	5	4	3	2	1
56	4	5	2	4	3	6	4	6	5	5	5	4	6	4	5	2	3	2	5	7	2	4	4	5	4	5
57	5	5	3	4	4	8	5	6	6	6	6	6	4	4	5	3	5	4	4	7	3	6	4	5	5	4
58	3	4	2	3	2	5	5	2	4	2	4	4	5	2	3	2	3	2	2	4	0	3	2	2	3	3
59	5	8	6	5	5	4	3	6	6	3	4	6	9	4	5	2	4	3	4	4	4	4	4	4	4	5
60	6	5	6	8	8	6	6	5	5	6	6	4	5	5	4	5	7	6	4	5	3	3	5	4	4	4
61	4	5	3	5	4	3	3	4	2	5	3	4	6	3	4	1	5	3	3	5	2	4	4	4	4	4
62	6	4	5	8	7	7	4	6	4	5	5	5	3	5	5	2	9	5	5	6	4	5	6	6	5	5
63	4	5	2	1	1	5	8	4	8	5	7	4	6	4	5	1	3	2	4	7	3	5	5	5	4	5
64	5	6	7	4	5	5	3	4	4	3	3	3	8	5	6	7	4	5	5	3	4	4	3	3	3	8
65	3	5	1	3	2	4	3	2	2	2	2	3	6	3	4	3	2	2	1	6	4	4	5	5	4	4
66	4	5	4	5	5	4	2	5	3	5	4	5	4	4	3	2	5	3	3	6	4	7	4	6	3	3

OBS. NO.	INITIAL DAT SCORES													SENIOR DAT SCORES											
67	4	7	7	3	4	3	4	1	3	1	2	4	9	4	5	4	4	4	3	8	3	5	5	6	4	6
68	4	5	4	4	4	3	4	4	4	4	4	4	5	2	3	1	4	3	0	4	1	2	3	2	2	4
69	5	4	6	5	6	3	6	4	4	6	5	3	5	5	3	3	5	4	5	6	5	6	5	6	3	2
70	5	6	8	5	6	3	5	4	4	5	5	5	6	5	4	6	4	5	3	6	6	6	6	6	4	2
71	5	5	6	4	5	3	5	8	7	7	7	4	6	4	5	4	4	4	4	5	5	4	6	5	4	5
72	4	7	4	1	2	6	4	5	6	4	5	4	9	4	5	2	4	3	3	6	4	5	5	5	5	5
73	4	7	3	6	5	4	3	2	3	2	2	5	9	3	4	2	5	4	2	5	2	4	2	3	3	5
74	5	5	4	4	4	6	7	6	7	7	7	4	5	6	4	3	4	3	6	9	6	7	9	8	4	4
75	5	6	6	4	5	3	4	6	5	5	5	7	5	5	6	5	4	4	4	6	5	5	6	6	8	4
76	4	5	4	3	3	5	5	5	4	6	5	6	4	4	5	4	3	3	5	5	5	6	4	5	6	4
77	5	5	6	4	5	5	6	6	6	6	6	6	3	5	6	5	4	4	6	4	4	6	3	4	7	5
78	5	5	4	7	7	6	6	2	4	3	4	4	5	5	5	4	7	7	6	6	2	4	3	4	4	5
79	5	5	4	4	4	6	4	7	6	6	6	4	6	6	6	5	6	6	5	6	8	7	7	7	7	4
80	6	3	6	6	6	6	7	6	5	7	7	3	3	5	4	4	7	6	6	5	4	5	4	5	6	2
81	4	5	3	7	5	4	4	3	3	3	3	6	3	4	5	2	7	4	4	6	3	4	5	5	6	3
82	4	6	2	4	3	4	6	4	5	5	5	4	7	2	4	1	2	1	3	3	2	3	2	3	4	3
83	5	6	6	4	5	4	3	6	5	5	5	6	6	2	5	2	4	3	2	3	1	2	2	2	6	3
84	5	4	4	7	6	5	6	4	6	5	4	4	3	5	4	3	5	4	4	8	4	6	4	6	5	3
85	6	4	6	7	8	6	6	6	8	5	7	3	5	5	5	2	6	4	5	6	4	6	4	5	4	5
86	6	4	3	9	7	5	6	7	8	6	7	4	4	4	4	1	6	4	6	4	5	6	4	5	2	5
87	6	3	6	2	2	3	4	3	3	4	4	7	5	5	6	5	4	4	6	7	2	5	4	5	6	5
88	4	5	2	3	2	6	5	4	4	5	5	4	5	3	5	2	5	3	2	5	3	4	4	4	4	5

OBS. NO.	INITIAL DAT SCORES													SENIOR DAT SCORES											
89	4	5	3	5	4	2	4	5	4	5	5	4	5	4	5	2	5	4	4	6	2	5	3	4	5	5
90	5	5	6	7	7	3	2	5	4	3	3	3	6	5	3	2	5	4	6	7	4	5	6	6	3	3
91	4	4	4	3	4	4	4	4	2	5	4	4	4	3	4	1	4	2	3	4	3	5	1	3	3	4
92	4	6	3	2	2	3	4	7	5	7	6	4	7	3	3	3	2	2	2	4	2	3	2	2	4	8
93	5	5	5	5	5	3	5	5	5	5	5	3	6	4	2	3	4	4	3	6	4	4	5	5	2	2
94	3	4	2	3	2	4	4	2	3	3	3	3	5	3	3	3	4	4	4	4	1	3	2	2	1	5
95	4	6	4	5	5	5	1	3	4	3	3	5	6	3	4	3	3	3	3	5	2	3	3	3	3	5
96	4	5	3	5	4	4	4	3	3	3	3	4	6	5	4	3	6	4	4	6	4	4	6	6	4	4
97	4	5	4	4	4	6	6	2	5	4	4	4	5	5	3	2	5	3	6	8	3	6	4	6	4	2
98	7	5	6	7	8	9	6	8	7	7	8	4	5	5	4	4	8	6	5	7	2	3	5	4	4	4
99	5	8	6	5	6	6	6	3	2	5	4	7	9	6	6	6	6	6	6	7	4	5	5	5	7	5
100	5	5	6	6	6	6	4	3	1	5	3	4	6	6	5	3	7	5	7	7	5	5	7	6	5	5
101	6	6	6	7	7	7	3	8	7	5	6	7	4	6	6	4	6	5	7	6	5	5	6	6	7	4
102	5	8	6	4	5	4	5	5	6	4	5	6	9	3	8	3	3	3	1	3	3	4	2	3	7	8
103	3	4	4	2	3	3	2	3	2	3	3	4	4	3	6	2	4	3	1	4	4	4	4	4	6	6
104	6	5	5	7	6	7	6	4	4	6	5	4	5	5	4	2	6	4	5	7	4	5	6	6	3	5
105	5	6	2	5	3	6	8	6	8	7	8	5	6	4	5	1	4	2	5	5	5	5	5	5	5	5
106	6	4	5	5	5	6	6	6	8	4	6	5	3	4	4	3	3	3	5	7	2	4	5	5	4	4
107	5	4	2	6	4	5	6	4	6	4	5	4	4	5	2	3	5	4	5	8	3	5	6	6	1	2

APPENDIX B

TABLE OF RESIDUALS - I

FRGPA/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.36	2.54
2	2.91	2.58
3	3.47	3.11
4	3.44	2.77
5	3.22	2.98
6	2.84	2.52
7	2.19	2.56
8	2.49	2.61
9	2.64	2.52
10	2.92	2.59
11	3.12	2.81
12	3.06	2.70
13	2.29	2.52
14	2.40	2.77
15	3.53	2.91
16	2.05	2.44
17	2.34	2.77
18	2.60	2.60
19	2.66	2.76
20	2.28	2.58

OBS. NO.	Y VALUE	X ESTIMATE
21	2.46	2.68
22	2.56	2.67
23	2.58	2.56
24	2.42	2.43
25	2.89	2.47
26	2.59	2.73
27	2.27	2.65
28	2.32	2.57
29	2.48	2.69
30	2.79	2.56
31	2.52	2.78
32	2.84	2.59
33	2.62	2.75
34	2.19	2.50
35	2.91	2.73
36	2.36	2.74
37	2.93	2.53
38	2.28	2.64
39	2.86	2.85
40	2.45	2.79
41	2.45	2.83
42	3.18	3.07

OBS. NO.	Y VALUE	X ESTIMATE
43	3.47	2.64
44	2.92	2.66
45	2.78	2.54
46	2.81	2.43
47	2.85	2.63
48	2.53	2.70
49	2.41	2.65
50	3.26	2.71
51	2.33	2.82
52	2.41	2.99
53	2.65	2.88
54	2.00	2.70
55	3.09	2.84
56	3.02	2.78
57	2.86	2.48
58	2.59	2.72
59	2.45	2.68
60	2.55	2.90
61	2.67	2.63
62	2.61	2.63
63	2.55	2.63
64	2.40	2.63

OBS. NO.	Y VALUE	X ESTIMATE
65	2.58	2.54
66	2.54	2.44
67	2.89	2.81
68	1.98	2.46
69	2.21	2.59
70	3.29	2.70
71	3.29	2.89
72	2.20	2.62
73	2.79	2.61
74	3.04	2.69
75	2.54	2.70
76	2.98	2.92
77	2.94	2.72
78	3.09	2.72
79	2.25	2.82
80	2.69	2.81
81	2.32	2.57
82	2.26	2.58
83	2.09	2.58
84	2.68	2.53
85	2.58	2.60
86	3.33	3.01

OBS. NO.	Y VALUE	X ESTIMATE
87	3.02	2.78
88	2.41	2.52
89	2.67	2.66
90	3.20	3.28
91	2.78	2.48
92	2.35	2.48
93	2.99	2.64
94	2.89	2.59
95	2.24	2.68
96	2.59	2.52
97	2.74	2.45
98	2.69	2.77
99	2.39	2.67
100	3.16	2.91
101	3.24	2.65
102	2.56	2.64
103	2.89	2.75
104	2.44	2.72
105	2.80	2.85
106	2.89	2.80
107	2.71	2.72

TABLE OF RESIDUALS - II

SOGPA/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.60	2.44
2	2.91	2.38
3	3.28	2.75
4	2.91	2.59
5	3.05	2.62
6	2.57	2.42
7	2.00	2.38
8	2.48	2.51
9	2.69	2.34
10	2.52	2.39
11	2.82	2.48
12	2.65	2.43
13	1.93	2.38
14	2.29	2.47
15	2.95	2.53
16	2.12	2.39
17	2.21	2.46
18	2.31	2.50
19	2.29	2.41
20	2.12	2.41

OBS. NO.	Y VALUE	X ESTIMATE
21	2.60	2.47
22	2.59	2.46
23	2.75	2.41
24	2.02	2.33
25	2.55	2.26
26	2.17	2.49
27	2.17	2.44
28	2.07	2.39
29	2.03	2.59
30	2.38	2.33
31	2.58	2.46
32	2.43	2.33
33	2.29	2.64
34	2.35	2.37
35	2.70	2.44
36	2.75	2.58
37	2.96	2.35
38	2.20	2.45
39	2.77	2.57
40	2.15	2.54
41	2.28	2.49
42	2.78	2.71

OBS. NO.	Y VALUE	X ESTIMATE
43	2.86	2.44
44	2.46	2.38
45	2.34	2.24
46	2.60	2.24
47	2.83	2.40
48	2.10	2.53
49	2.32	2.42
50	3.33	2.57
51	2.24	2.48
52	2.21	2.56
53	2.47	2.64
54	2.00	2.39
55	2.98	2.57
56	2.89	2.63
57	2.70	2.32
58	2.17	2.59
59	2.20	2.44
60	2.13	2.53
61	2.29	2.38
62	2.02	2.47
63	2.23	2.47
64	2.05	2.38

OBS. NO.	Y VALUE	X ESTIMATE
65	2.40	2.36
66	2.26	2.29
67	2.67	2.53
68	2.04	2.29
69	2.08	2.32
70	2.60	2.48
71	2.57	2.66
72	2.26	2.45
73	2.21	2.32
74	2.61	2.45
75	1.94	2.46
76	2.38	2.70
77	2.43	2.47
78	2.25	2.35
79	2.21	2.62
80	2.88	2.64
81	3.15	2.39
82	2.11	2.36
83	1.97	2.39
84	2.07	2.30
85	2.22	2.34
86	2.92	2.64

OBS. NO.	Y VALUE	X ESTIMATE
87	3.31	2.62
88	2.08	2.41
89	2.67	2.49
90	2.21	2.80
91	2.50	2.35
92	2.24	2.37
93	2.80	2.38
94	3.01	2.49
95	2.23	2.45
96	2.16	2.36
97	2.33	2.22
98	2.61	2.46
99	2.08	2.32
100	2.93	2.62
101	2.85	2.42
102	2.24	2.36
103	2.46	2.60
104	2.21	2.41
105	2.62	2.62
106	2.62	2.53
107	2.90	2.47

TABLE OF RESIDUALS - III

JRGPA/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.88	2.89
2	3.01	2.86
3	3.19	3.21
4	2.90	2.91
5	3.07	2.95
6	3.11	2.97
7	2.78	2.83
8	2.92	2.99
9	2.76	2.88
10	2.72	2.83
11	2.86	2.78
12	3.13	2.82
13	2.84	3.01
14	3.09	3.01
15	3.11	3.10
16	2.80	2.76
17	2.80	2.91
18	3.03	2.91
19	2.74	2.86
20	2.78	2.82

OBS. NO.	Y VALUE	X ESTIMATE
21	2.82	2.74
22	3.13	3.04
23	3.17	2.86
24	2.47	2.80
25	2.88	2.84
26	2.68	2.83
27	2.62	2.84
28	3.00	2.81
29	2.96	2.93
30	3.07	2.93
31	3.19	3.14
32	2.86	2.87
33	2.90	2.88
34	2.82	2.76
35	3.29	2.81
36	3.13	3.00
37	3.52	2.96
38	2.70	2.83
39	3.13	3.16
40	2.94	3.04
41	2.72	2.81
42	3.23	3.09

OBS. NO.	Y VALUE	X ESTIMATE
43	3.37	2.90
44	2.72	2.71
45	2.94	2.68
46	3.03	2.81
47	2.82	2.81
48	2.78	2.95
49	2.80	2.85
50	3.49	3.11
51	2.82	2.89
52	2.62	2.89
53	3.19	3.12
54	2.98	2.89
55	3.05	2.88
56	3.19	2.93
57	2.21	2.68
58	3.03	2.94
59	2.92	2.88
60	3.03	3.05
61	2.68	2.84
62	2.52	2.82
63	2.34	2.87
64	2.72	2.96

OBS. NO.	Y VALUE	X ESTIMATE
65	2.74	2.90
66	3.00	2.83
67	2.96	3.11
68	2.43	2.85
69	2.92	2.87
70	3.13	3.01
71	2.62	3.03
72	2.76	3.00
73	2.82	2.89
74	3.27	2.88
75	2.70	2.83
76	2.90	2.94
77	2.94	2.83
78	2.88	2.97
79	2.21	2.99
80	2.31	2.98
81	2.13	2.75
82	2.80	2.91
83	2.68	2.83
84	2.62	2.77
85	3.00	2.87
86	3.27	2.81

OBS. NO.	Y VALUE	X ESTIMATE
87	3.37	2.99
88	2.76	2.84
89	3.01	2.96
90	3.01	3.18
91	3.09	2.95
92	2.86	2.88
93	3.29	2.86
94	3.35	2.94
95	3.09	2.99
96	2.90	2.79
97	2.80	2.76
98	2.82	2.95
99	2.50	2.97
100	3.25	3.09
101	3.29	2.75
102	2.96	2.94
103	3.13	3.05
104	2.82	2.87
105	3.05	2.88
106	3.11	2.78
107	2.21	2.71

TABLE OF RESIDUALS - IV

SRGPA/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	3.32	3.24
2	3.44	3.24
3	3.75	3.56
4	3.41	3.39
5	3.03	3.16
6	3.56	3.42
7	2.89	3.26
8	3.26	3.28
9	3.38	3.28
10	3.21	3.19
11	3.09	3.12
12	3.31	3.26
13	3.35	3.37
14	3.65	3.33
15	3.21	3.34
16	3.25	3.34
17	2.93	3.16
18	3.29	3.31
19	2.93	3.11
20	2.89	3.13

OBS. NO.	Y VALUE	X ESTIMATE
21	3.17	3.16
22	3.50	3.39
23	3.46	3.25
24	2.61	3.26
25	2.97	3.15
26	3.14	3.17
27	3.09	3.15
28	3.40	3.19
29	3.77	3.41
30	3.45	3.29
31	3.17	3.39
32	3.53	3.22
33	3.17	3.42
34	3.13	3.13
35	3.43	3.19
36	3.28	3.31
37	3.75	3.36
38	3.34	3.20
39	3.52	3.57
40	3.42	3.33
41	3.11	3.24
42	3.63	3.32

OBS. NO.	Y VALUE	X ESTIMATE
43	3.80	3.17
44	3.22	3.12
45	3.00	2.95
46	3.43	3.16
47	3.01	3.03
48	2.88	3.34
49	3.09	3.19
50	3.81	3.51
51	2.96	3.19
52	2.94	3.16
53	3.5	3.48
54	3.22	3.18
55	3.41	3.18
56	3.77	3.40
57	2.77	3.09
58	3.57	3.46
59	3.39	3.26
60	3.50	3.25
61	3.11	3.22
62	3.27	3.22
63	3.22	3.28
64	3.14	3.29

OBS. NO.	Y VALUE	X ESTIMATE
65	3.06	3.38
66	3.23	3.20
67	3.14	3.47
68	2.91	3.21
69	3.30	3.07
70	3.22	3.28
71	2.88	3.30
72	3.02	3.40
73	3.23	3.29
74	3.57	3.18
75	2.91	3.18
76	3.08	3.38
77	2.97	3.14
78	3.01	3.22
79	2.96	3.39
80	2.57	3.28
81	2.84	3.21
82	2.85	3.29
83	2.92	3.18
84	2.92	3.09
85	3.18	3.04
86	3.30	3.09

OBS. NO.	Y VALUE	X ESTIMATE
87	3.89	3.48
88	3.42	3.30
89	3.41	3.34
90	3.37	3.45
91	3.32	3.33
92	3.19	3.26
93	3.67	3.13
94	3.90	3.45
95	3.19	3.39
96	3.67	3.23
97	3.15	3.10
98	2.98	3.13
99	3.23	3.25
100	3.50	3.44
101	3.44	3.11
102	3.51	3.24
103	3.55	3.47
104	3.25	3.18
105	3.48	3.29
106	3.37	3.15
107	3.10	3.13

TABLE OF RESIDUALS - V

FINGPA/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.81	2.79
2	3.07	2.77
3	3.42	3.18
4	3.15	2.94
5	3.09	2.93
6	3.03	2.84
7	2.48	2.78
8	2.80	2.85
9	2.87	2.77
10	2.84	2.75
11	2.97	2.79
12	3.04	2.82
13	2.62	2.83
14	2.88	2.90
15	3.19	2.98
16	2.58	2.76
17	2.58	2.83
18	2.82	2.85
19	2.66	2.79
20	2.53	2.75

OBS. NO.	Y VALUE	X ESTIMATE
21	2.77	2.78
22	2.96	2.92
23	3.01	2.79
24	2.38	2.73
25	2.82	2.69
26	2.65	2.81
27	2.55	2.79
28	2.72	2.74
29	2.83	2.92
30	2.94	2.80
31	2.88	2.95
32	2.92	2.76
33	2.75	2.94
34	2.64	2.69
35	3.10	2.82
36	2.90	2.90
37	3.31	2.83
38	2.64	2.80
39	3.08	3.05
40	2.76	2.95
41	2.65	2.85
42	3.21	3.06

OBS. NO.	Y VALUE	X ESTIMATE
43	3.33	2.78
44	2.83	2.72
45	2.77	2.60
46	2.98	2.69
47	2.87	2.74
48	2.58	2.89
49	2.67	2.80
50	3.48	2.99
51	2.61	2.86
52	2.55	2.89
53	2.97	3.04
54	2.57	2.80
55	3.14	2.87
56	3.23	2.95
57	2.62	2.66
58	2.86	2.96
59	2.75	2.81
60	2.82	2.93
61	2.69	2.78
62	2.61	2.78
63	2.75	2.86
64	2.59	2.82

OBS. NO.	Y VALUE	X ESTIMATE
65	2.76	2.82
66	2.77	2.70
67	2.92	2.99
68	2.35	2.71
69	2.65	2.72
70	3.06	2.86
71	2.83	2.98
72	2.58	2.89
73	2.77	2.79
74	3.13	2.82
75	2.53	2.80
76	2.84	2.99
77	2.82	2.79
78	2.81	2.82
79	2.54	2.98
80	2.58	2.93
81	2.62	2.73
82	2.52	2.80
83	2.44	2.76
84	2.58	2.68
85	2.76	2.73
86	3.21	2.89

OBS. NO.	Y VALUE	X ESTIMATE
87	3.41	2.99
88	2.68	2.78
89	2.95	2.87
90	2.95	3.18
91	2.94	2.80
92	2.68	2.77
93	3.20	2.76
94	3.30	2.90
95	2.71	2.90
96	2.84	2.73
97	2.76	2.65
98	2.76	2.82
99	2.56	2.80
100	3.21	3.01
101	3.21	2.73
102	2.83	2.8
103	3.02	2.99
104	2.69	2.80
105	3.00	2.93
106	3.01	2.84
107	2.76	2.77

TABLE OF RESIDUALS - VI

FRGPA/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.36	2.41
2	2.91	2.61
3	3.47	3.29
4	3.44	2.85
5	3.22	2.93
6	2.84	2.72
7	2.19	2.35
8	2.49	2.87
9	2.64	2.58
10	2.92	2.54
11	3.12	2.97
12	2.06	2.72
13	2.29	2.49
14	2.40	2.70
15	3.53	2.94
16	2.05	2.53
17	2.34	2.67
18	2.60	2.61
19	2.66	2.75
20	2.28	2.55

OBS. NO.	Y VALUE	X ESTIMATE
21	2.46	2.81
22	2.56	2.51
23	2.58	2.73
24	2.42	2.51
25	2.89	2.49
26	2.59	2.75
27	2.27	2.60
28	2.37	2.41
29	2.48	2.80
30	2.79	2.76
31	2.52	2.50
32	2.84	2.56
33	2.62	2.83
34	2.19	2.42
35	2.91	2.78
36	2.36	2.71
37	2.93	2.75
38	2.28	2.59
39	2.86	2.79
40	2.45	2.71
41	2.45	2.86
42	3.18	2.91

OBS. NO.	Y VALUE	X ESTIMATE
43	3.47	2.82
44	2.92	2.90
45	2.78	2.40
46	2.81	2.49
47	2.85	2.75
48	2.53	2.69
49	2.41	2.77
50	3.26	2.81
51	2.33	2.79
52	2.41	2.92
53	2.65	3.05
54	2.00	2.57
55	3.09	2.73
56	3.02	3.04
57	2.86	2.47
58	2.59	2.47
59	2.45	2.73
60	2.55	2.70
61	2.67	2.50
62	2.61	2.70
63	2.55	2.64
64	2.40	2.79

OBS. NO.	Y VALUE	X ESTIMATE
65	2.58	2.47
66	2.54	2.51
67	2.89	2.84
68	1.98	2.16
69	2.21	2.63
70	3.29	2.46
71	3.29	2.84
72	2.20	2.53
73	2.79	2.55
74	3.04	2.67
75	2.54	2.66
76	2.98	2.78
77	2.94	2.73
78	3.09	2.88
79	2.25	2.86
80	2.69	2.72
81	2.32	2.61
82	2.26	2.42
83	2.09	2.36
84	2.68	2.72
85	2.58	2.72
86	3.33	3.13

OBS. NO.	Y VALUE	X ESTIMATE
87	3.02	2.97
88	2.41	2.41
89	2.67	2.69
90	3.20	3.30
91	2.78	2.55
92	2.35	2.18
93	2.99	2.50
94	2.89	2.59
95	2.24	2.65
96	2.59	2.64
97	2.74	2.65
98	2.69	2.54
99	2.39	2.58
100	3.16	2.89
101	3.24	2.86
102	2.56	2.61
103	2.89	2.64
104	2.44	2.74
105	2.80	2.82
106	2.89	2.83
107	2.71	2.70

TABLE OF RESIDUALS - VII

SOGPA/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.60	2.42
2	2.91	2.53
3	3.28	2.98
4	2.91	2.51
5	3.05	2.85
6	2.57	2.44
7	2.00	2.24
8	2.48	2.63
9	2.69	2.40
10	2.52	2.39
11	2.82	2.64
12	2.65	2.44
13	1.93	2.35
14	2.29	2.45
15	2.95	2.66
16	2.12	2.37
17	2.21	2.48
18	2.31	2.44
19	2.29	2.52
20	2.12	2.40

OBS. NO.	Y VALUE	X ESTIMATE
21	2.60	2.62
22	2.59	2.26
23	2.75	2.58
24	2.02	2.36
25	2.55	2.29
26	2.17	2.60
27	2.17	2.52
28	2.07	2.25
29	2.03	2.49
30	2.38	2.50
31	2.58	2.41
32	2.43	2.40
33	2.29	2.59
34	2.35	2.34
35	2.70	2.56
36	2.75	2.54
37	2.96	2.51
38	2.20	2.48
39	2.77	2.51
40	2.15	2.55
41	2.28	2.54
42	2.78	2.60

OBS. NO.	Y VALUE	X ESTIMATE
43	2.86	2.59
44	2.46	2.62
45	2.34	2.20
46	2.60	2.30
47	2.83	2.65
48	2.10	2.37
49	2.32	2.58
50	3.33	2.59
51	2.24	2.55
52	2.21	2.67
53	2.47	2.74
54	2.00	2.37
55	2.98	2.62
56	2.89	2.75
57	2.70	2.37
58	2.17	2.33
59	2.20	2.38
60	2.13	2.38
61	2.29	2.32
62	2.02	2.36
63	2.23	2.44
64	2.05	2.47

OBS. NO.	Y VALUE	X ESTIMATE
65	2.40	2.34
66	2.26	2.39
67	2.67	2.72
68	2.04	2.09
69	2.08	2.42
70	2.60	2.32
71	2.57	2.52
72	2.26	2.30
73	2.21	2.35
74	2.61	2.45
75	1.94	2.39
76	2.38	2.41
77	2.43	2.37
78	2.25	2.66
79	2.21	2.44
80	2.88	2.42
81	3.15	2.34
82	2.11	2.18
83	1.97	2.20
84	2.07	2.49
85	2.22	2.41
86	2.92	2.65

OBS. NO.	Y VALUE	X ESTIMATE
87	3.31	2.74
88	2.08	2.24
89	2.67	2.46
90	2.21	2.82
91	2.50	2.27
92	2.24	1.95
93	2.80	2.36
94	3.01	2.42
95	2.23	2.43
96	2.16	2.40
97	2.33	2.46
98	2.61	2.29
99	2.08	2.33
100	2.93	2.44
101	2.85	2.48
102	2.24	2.37
103	2.46	2.32
104	2.21	2.47
105	2.62	2.36
106	2.62	2.65
107	2.09	2.55

TABLE OF RESIDUALS - VIII

JRGPA/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.88	2.80
2	3.01	2.80
3	3.19	3.24
4	2.90	2.96
5	3.07	2.98
6	3.11	2.86
7	2.78	2.73
8	2.92	3.06
9	2.76	2.93
10	2.72	2.72
11	2.86	2.85
12	3.13	2.84
13	2.84	2.88
14	3.09	3.04
15	3.11	3.02
16	2.80	2.81
17	2.80	2.86
18	3.03	2.96
19	2.74	2.89
20	2.78	2.69

OBS. NO.	Y VALUE	X ESTIMATE
21	2.82	3.11
22	3.13	2.73
23	3.17	2.81
24	2.47	3.00
25	2.88	2.95
26	2.68	2.84
27	2.62	2.83
28	3.00	2.85
29	2.96	2.98
30	3.07	3.10
31	3.19	2.90
32	2.86	2.89
33	2.90	2.93
34	2.82	2.65
35	3.29	2.99
36	3.13	2.97
37	3.52	3.20
38	2.70	2.87
39	3.13	3.06
40	2.94	2.95
41	2.72	2.87
42	3.23	2.97

OBS. NO.	Y VALUE	X ESTIMATE
43	3.37	2.94
44	2.72	3.02
45	2.94	2.59
46	3.03	3.00
47	2.82	2.96
48	2.78	2.75
49	2.80	2.94
50	3.49	3.05
51	2.82	2.84
52	2.62	2.96
53	3.19	3.10
54	2.98	2.93
55	3.05	3.06
56	3.19	3.09
57	2.21	2.67
58	3.03	2.88
59	2.92	2.99
60	3.03	2.91
61	2.68	2.81
62	2.52	2.84
63	2.34	2.93
64	2.72	3.14

OBS. NO.	Y VALUE	X ESTIMATE
65	2.74	2.82
66	3.00	2.93
67	2.96	2.95
68	2.43	2.77
69	2.92	2.88
70	3.13	2.75
71	2.62	2.91
72	2.76	2.83
73	2.82	2.82
74	3.27	2.89
75	2.70	2.89
76	2.90	2.82
77	2.94	3.00
78	2.88	2.98
79	2.21	2.84
80	2.31	2.81
81	2.13	2.71
82	2.80	2.81
83	2.68	2.71
84	2.62	2.89
85	3.00	2.93
86	3.27	3.01

OBS. NO.	Y VALUE	X ESTIMATE
87	3.37	3.08
88	2.76	2.69
89	3.01	2.96
90	3.01	3.14
91	3.09	2.91
92	2.86	2.92
93	3.29	2.79
94	3.35	2.98
95	3.09	2.93
96	2.90	2.94
97	2.80	2.85
98	2.82	2.62
99	2.50	2.75
100	3.25	2.88
101	3.29	2.94
102	2.96	3.05
103	3.13	2.96
104	2.82	2.93
105	3.05	2.91
106	3.11	3.03
107	2.21	2.85

TABLE OF RESIDUALS - IX

SRGPA/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	3.32	3.27
2	3.44	3.14
3	3.75	3.60
4	3.41	3.25
5	3.03	3.21
6	3.56	3.26
7	2.89	3.10
8	3.26	3.35
9	3.38	3.35
10	3.21	3.05
11	3.09	3.19
12	3.31	3.22
13	3.35	3.35
14	3.65	3.39
15	3.21	3.43
16	3.25	3.17
17	2.93	3.15
18	3.29	3.43
19	2.93	3.21
20	2.89	2.99

OBS. NO.	Y VALUE	X ESTIMATE
21	3.17	3.56
22	3.50	3.05
23	3.46	3.19
24	2.61	3.37
25	2.97	3.25
26	3.14	3.23
27	3.09	3.11
28	3.40	3.19
29	3.77	3.33
30	3.45	3.45
31	3.17	3.20
32	3.53	3.37
33	3.17	3.03
34	3.13	2.98
35	3.43	3.27
36	3.28	3.25
37	3.75	3.58
38	3.34	3.28
39	3.52	3.50
40	3.42	3.21
41	3.42	3.21
42	3.63	3.45

OBS. NO.	Y VALUE	X ESTIMATE
43	3.80	3.37
44	3.22	3.53
45	3.00	2.89
46	3.43	3.46
47	3.01	3.10
48	2.88	3.08
49	3.09	3.30
50	3.81	3.45
51	2.96	3.06
52	2.94	3.24
53	3.50	3.54
54	3.22	3.24
55	3.41	3.34
56	3.77	3.52
57	2.77	2.93
58	3.57	3.19
59	3.39	3.38
60	3.50	3.31
61	3.11	3.20
62	3.27	3.36
63	3.22	3.32
64	3.14	3.45

OBS. NO.	Y VALUE	X ESTIMATE
65	3.06	3.23
66	3.23	3.28
67	3.14	3.29
68	2.91	3.20
69	3.30	3.23
70	3.22	3.01
71	2.88	3.29
72	3.02	3.17
73	3.23	3.08
74	3.57	3.27
75	2.91	3.30
76	3.08	3.17
77	2.97	3.22
78	3.01	3.29
79	2.96	3.07
80	2.57	3.11
81	2.84	3.20
82	2.85	3.20
83	2.92	3.14
84	2.92	3.23
85	3.18	3.25
86	3.30	3.23

OBS. NO.	Y VALUE	X ESTIMATE
87	3.89	3.43
88	3.42	3.09
89	3.41	3.26
90	3.37	3.43
91	3.32	3.26
92	3.19	3.20
93	3.67	3.13
94	3.90	3.30
95	3.19	3.29
96	3.67	3.48
97	3.15	3.22
98	2.98	2.97
99	3.23	3.04
100	3.50	3.26
101	3.44	3.48
102	3.51	3.43
103	3.55	3.29
104	3.25	3.37
105	3.48	3.28
106	3.37	3.45
107	3.10	3.19

TABLE OF RESIDUALS - X

FINGPA/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE
1	2.81	2.74
2	3.07	2.78
3	3.42	3.28
4	3.15	2.91
5	3.09	3.00
6	3.03	2.83
7	2.48	2.61
8	2.80	3.00
9	2.87	2.83
10	2.84	2.70
11	2.97	2.91
12	3.04	2.82
13	2.62	2.78
14	2.88	2.90
15	3.19	3.00
16	2.58	2.73
17	2.58	2.80
18	2.82	2.88
19	2.66	2.85
20	2.53	2.67

OBS. NO.	Y VALUE	X ESTIMATE
21	2.77	3.04
22	2.96	2.65
23	3.01	2.82
24	2.38	2.83
25	2.82	2.76
26	2.65	2.85
27	2.55	2.79
28	2.72	2.69
29	2.83	2.91
30	2.94	2.97
31	2.88	2.77
32	2.92	2.82
33	2.75	2.91
34	2.64	2.61
35	3.1	2.90
36	2.90	2.87
37	3.31	3.03
38	2.64	2.81
39	3.08	2.98
40	2.76	2.86
41	2.65	2.88
42	3.21	2.99

OBS. NO.	Y VALUE	X ESTIMATE
43	3.33	2.93
44	2.83	3.03
45	2.77	2.53
46	2.98	2.84
47	2.87	2.88
48	2.58	2.75
49	2.67	2.90
50	3.48	3.00
51	2.60	2.82
52	2.55	2.95
53	2.97	3.12
54	2.57	2.80
55	3.14	2.95
56	3.23	3.10
57	2.62	2.62
58	2.86	2.73
59	2.75	2.89
60	2.82	2.84
61	2.69	2.72
62	2.61	2.81
63	2.75	2.86
64	2.59	2.97

OBS. NO.	Y VALUE	X ESTIMATE
65	2.76	2.74
66	2.77	2.79
67	2.92	2.95
68	2.35	2.58
69	2.65	2.80
70	3.06	2.66
71	2.83	2.91
72	2.58	2.73
73	2.77	2.71
74	3.13	2.84
75	2.53	2.83
76	2.84	2.81
77	2.82	2.85
78	2.81	2.95
79	2.54	2.82
80	2.58	2.76
81	2.62	2.72
82	2.52	2.68
83	2.44	2.62
84	2.58	2.84
85	2.76	2.84
86	3.21	3.01

OBS. NO.	Y VALUE	X ESTIMATE
87	3.41	3.06
88	2.68	2.62
89	2.95	2.86
90	2.95	3.19
91	2.94	2.76
92	2.68	2.58
93	3.20	2.71
94	3.30	2.84
95	2.71	2.84
96	2.84	2.87
97	2.76	2.80
98	2.76	2.60
99	2.56	2.69
100	3.21	2.88
101	3.21	2.92
102	2.83	2.89
103	3.02	2.81
104	2.69	2.88
105	3.00	2.86
106	3.01	3.00
107	2.76	2.83

TABLE OF RESIDUALS - XI

NATLBD/IDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
1	76.00	82.61	F	F
2	89.00	83.80		
3	89.00	86.97		
4	90.00	85.87		
5	91.00	86.64		
6	86.00	85.05		
7	82.00	85.51		
8	86.00	86.01		
9	85.00	84.56		
10	88.00	85.21		
11	93.00	89.15		
12	89.00	85.56		
13	80.00	82.75		
14	80.00	85.92		
15	88.00	87.03		
16	83.00	84.61		
17	85.00	86.78		
18	83.00	83.40		
19	87.00	85.19		
20	87.00	85.19		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
21	84.00	84.80		
22	84.00	85.42		
23	88.00	85.20		
24	78.00	81.31		F
25	86.00	82.79		
26	86.00	86.35		
27	85.00	85.78		
28	80.00	84.90	F	
29	82.00	85.61		
30	80.00	83.82		
31	86.00	85.60		
32	88.00	84.61		
33	88.00	88.00		
34	89.00	84.64		
35	87.00	87.36		
36	89.00	85.95		
37	86.00	83.09		
38	83.00	83.83		
39	87.00	86.00		
40	85.00	84.56		
41	90.00	88.85		
42	88.00	89.50		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
43	92.00	85.46		
44	91.00	85.85		
45	86.00	83.69		
46	81.00	82.57		
47	85.00	85.77		
48	86.00	85.29		
49	88.00	84.67		
50	92.00	85.80		
51	87.00	87.26		
52	84.00	87.95		
53	91.00	88.54		
54	84.00	84.84		
55	87.00	87.37		
56	90.00	87.81		
57	82.00	85.11		
58	82.00	86.26	F	
59	81.00	85.21		
60	84.00	88.51		
61	82.00	84.37		
62	89.00	87.50		
63	84.00	84.00		
64	84.00	84.39		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
65	84.00	83.21		
66	84.00	82.94		
67	85.00	84.03		
68	81.00	82.79		
69	82.00	84.19		
70	87.00	84.38		
71	88.00	87.56		
72	87.00	84.12		
73	82.00	83.98		
74	91.00	86.66		
75	83.00	84.66		
76	86.00	87.87		
77	87.00	86.53		
78	89.00	86.06		
79	86.00	87.62		
80	82.00	88.46		
81	81.00	85.07		
82	81.00	84.77		
83	77.00	83.47	F	F
84	86.00	85.23		
85	86.00	85.53		
86	91.00	89.24		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
87	90.00	84.48		
88	84.00	83.99		
89	80.00	84.43		F
90	88.00	89.58		
91	84.00	83.93		
92	84.00	83.27		
93	87.00	84.22		
94	88.00	84.22		
95	84.00	84.33		
96	85.00	83.92		
97	86.00	83.42		
98	87.00	88.37		
99	84.00	85.07		
100	87.00	88.36		
101	90.00	86.49		
102	81.00	84.33		
103	84.00	83.76		
104	84.00	86.91		
105	86.00	87.88		
106	85.00	87.02		
107	84.00	85.67		

TABLE OF RESIDUALS - XII

NATLBD/SDAT; COLGPA; SCIGPA

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
1	76.00	82.85	F	F
2	89.00	85.96		
3	89.00	90.62		
4	90.00	87.95		
5	91.00	88.59		
6	86.00	84.52		
7	82.00	82.15		
8	86.00	88.67		
9	85.00	85.58		
10	88.00	84.64		
11	93.00	89.98		
12	89.00	86.70		
13	80.00	82.06		
14	80.00	84.05		
15	88.00	87.75		
16	83.00	84.27		
17	85.00	87.10		
18	83.00	84.91		
19	87.00	85.93		
20	87.00	86.58		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
21	84.00	85.37		
22	84.00	84.50		
23	88.00	88.43		
24	78.00	81.94		F
25	86.00	82.56		
26	86.00	88.71		
27	85.00	86.64		
28	80.00	80.95	F	
29	82.00	84.23		
30	80.00	84.67		
31	86.00	82.58		
32	88.00	84.53		
33	88.00	86.67		
34	89.00	85.41		
35	87.00	86.67		
36	89.00	84.55		
37	86.00	84.90		
38	83.00	84.26		
39	87.00	82.67		
40	85.00	85.72		
41	90.00	88.76		
42	88.00	86.92		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
43	92.00	87.40		
44	91.00	87.89		
45	86.00	84.94		
46	81.00	82.35		
47	85.00	87.39		
48	86.00	87.36		
49	88.00	87.55		
50	92.00	86.75		
51	87.00	88.18		
52	84.00	87.82		
53	91.00	89.30		
54	84.00	83.10		
55	87.00	84.49		
56	90.00	87.69		
57	82.00	84.71		
58	82.00	81.67	F	
59	81.00	84.17		
60	84.00	85.20		
61	82.00	83.43		
62	89.00	87.40		
63	84.00	85.27		
64	84.00	84.44		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
65	84.00	83.12		
66	84.00	84.50		
67	85.00	88.10		
68	81.00	80.12		
69	82.00	84.71		
70	87.00	83.09		
71	88.00	86.65		
72	87.00	84.15		
73	82.00	84.51		
74	91.00	87.39		
75	83.00	84.40		
76	86.00	85.36		
77	87.00	84.14		
78	89.00	87.73		
79	86.00	87.94		
80	82.00	85.42		
81	81.00	85.43		
82	81.00	80.82		
83	77.00	80.04	F	F
84	86.00	87.22		
85	86.00	86.45		
86	91.00	89.35		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
87	90.00	87.34		
88	84.00	83.04		
89	80.00	85.94		F
90	88.00	91.24		
91	84.00	83.89		
92	84.00	80.93		
93	87.00	83.42		
94	88.00	84.17		
95	84.00	84.68		
96	85.00	84.49		
97	86.00	85.96		
98	87.00	85.62		
99	84.00	85.45		
100	87.00	88.98		
101	90.00	86.53		
102	81.00	82.41		
103	84.00	84.22		
104	84.00	87.77		
105	86.00	86.55		
106	85.00	86.54		
107	84.00	85.80		

TABLE OF RESIDUALS - XIII

NATLBD/FINGPA

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
1	76.00	85.26	F	F
2	89.00	87.25		
3	89.00	89.94		
4	90.00	87.87		
5	91.00	87.41		
6	86.00	86.95		
7	82.00	82.73		
8	86.00	85.18		
9	85.00	85.72		
10	88.00	85.49		
11	93.00	86.49		
12	89.00	87.02		
13	80.00	83.80		
14	80.00	85.80		
15	88.00	88.18		
16	83.00	83.49		
17	85.00	83.49		
18	83.00	85.34		
19	87.00	84.11		
20	87.00	83.11		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
21	84.00	84.96		
22	84.00	86.41		
23	88.00	86.79		
24	78.00	81.96		
25	86.00	85.34		
26	86.00	84.03		
27	85.00	83.26		
28	80.00	84.57	F	
29	82.00	85.41		
30	80.00	86.26		
31	86.00	85.80		
32	88.00	86.10		
33	88.00	84.80		
34	89.00	83.96		
35	87.00	87.49		
36	89.00	85.95		
37	86.00	89.10		
38	83.00	83.95		
39	87.00	87.33		
40	85.00	84.88		
41	90.00	84.03		
42	88.00	88.33		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
43	92.00	89.25		
44	91.00	85.41		
45	86.00	84.95		
46	81.00	86.56		
47	85.00	85.72		
48	86.00	83.49		
49	88.00	84.18		
50	92.00	90.40		
51	87.00	83.65		
52	84.00	83.26		
53	91.00	86.49		
54	84.00	83.42		
55	87.00	87.79		
56	90.00	88.48		
57	82.00	83.80		
58	82.00	85.64	F	
59	81.00	84.80		
60	84.00	85.34		
61	82.00	84.34		
62	89.00	83.72		
63	84.00	84.80		
64	84.00	83.57		

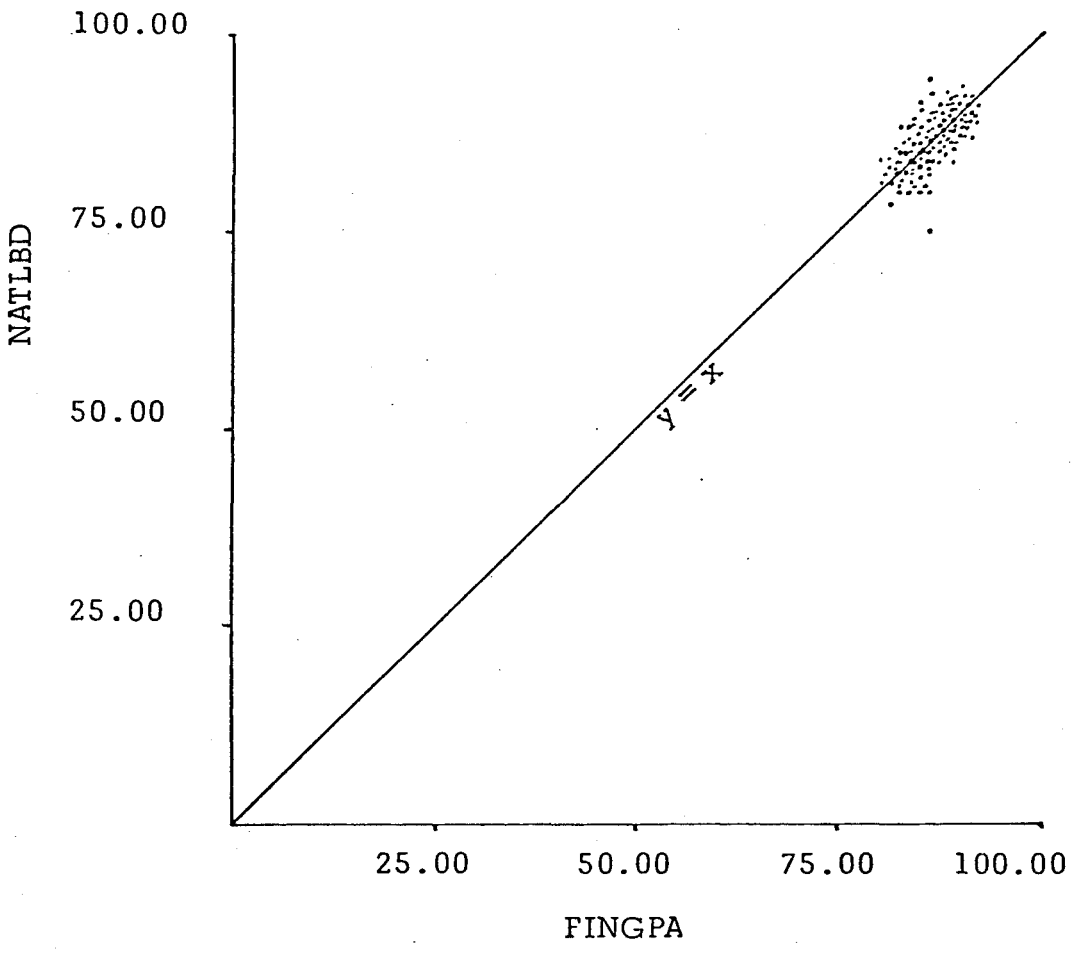
OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
65	84.00	84.88		
66	84.00	84.95		
67	85.00	86.10		
68	81.00	81.73		
69	82.00	84.03		
70	87.00	87.18		
71	88.00	85.41		
72	87.00	83.49		
73	82.00	84.95		
74	91.00	87.72		
75	83.00	83.11		
76	86.00	85.49		
77	87.00	85.34		
78	89.00	85.26		
79	86.00	83.19		
80	82.00	83.49		
81	81.00	83.80		
82	81.00	83.03		
83	77.00	82.42	F	F
84	86.00	83.49		
85	86.00	84.88		
86	91.00	88.33		

OBS. NO.	Y VALUE	X ESTIMATE	PT. I	PT. II
87	90.00	89.86		
88	84.00	84.26		
89	80.00	86.33	F	
90	90.00	86.33		
91	84.00	86.26		
92	84.00	84.26		
93	87.00	88.25		
94	88.00	89.02		
95	84.00	84.49		
96	85.00	85.49		
97	86.00	84.88		
98	87.00	84.88		
99	84.00	83.34		
100	87.00	88.33		
101	90.00	88.33		
102	81.00	85.41		
103	84.00	86.87		
104	84.00	84.34		
105	86.00	86.72		
106	85.00	86.79		
107	84.00	84.88		

APPENDIX C

NATLBD/FINGPA (Scattergram plot)

(National Board Examination/Final Grade Point Average)



APPROVAL SHEET

The thesis submitted by Dr. James N. Kouracos has been read and approved by the following committee:

Dr. William F. Malone, Director
Professor, Fixed Prosthodontics, Loyola Dental School

Dr. James Sandrik
Associate Professor, Dental Materials,
Loyola Dental School

Dr. Douglas C. Bowman
Associate Professor, Physiology/Pharmacology,
Loyola Dental School

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the Committee with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Science.

4/19/79
Date

William F. Malone
Director's Signature