# A Dissortation <br> presented to <br> the Faculty of the College of Education the University of Houston 

In Partial Fulfillment of the Reguiraments for the Degree Doctor of Education
by
Kenneth A* ziller
August, 1953

A STUDY OF THE RELATIONSHIP BETMEEX UNDFRGRADUATE AND GRADUATE marks in selected texas schoois

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The purpose of this investigation was to make a atudy of the relationships existing between undergraduate marks and Eraduate marks as a possible means of predicting graduate school success in alne Toxas colleges and univorsities. These relationships were established through computing correlations between the eradea gathered on 3,000 graduate students who had been awardea the master's degree from 1947-48 through 1951-52. Such factor: as aex differences, veteran or nonveteran atatus, transfors and non-transfors, areas of academic stuay, and the time-lag factor betweon the awarding of the baccalaureate and graduate degrees were studied to determine their effect on the relationshipe.

An adjustment factor consisting of an arbitrarily devised syster of penaltios was applied to each eraduate grado-point average in order to provido a spread of graduate marks at least equal to that possible for undergraduate work. This adjustment factor served another purpose in that it afforded a quantitative value to qualitative factors usualy deemed worthy mone graduate atudents. However, it was seldom found that this factor materially changed the magnitude of the coefficienta of correlation.

The relationships between the grade-point averages for undergraduate and regular graduate, as well as the adjusted
graduate, courses were determined at three stages of the undergraduate etudy: (1) the freshman-sophomore level: (2) the funior-aenior level; and (3) the total undergraduate level. These correlations for the various levels of data were carriod though all the smueratod factora.

There was "marked" relationship between undergreduate and eraduate marks in the schools studied, and it was found that funior-senior work provided the best index for prediction of Eraduate auccsas. When themalea and females were divided, no algnificant differences were revealed except at the freshmansophomore level where the relationship between undergraduate and Eraduate marla was unusually high for the females. The females consistently made higher averages on this as well as other factore then did the males. The non-veterans not only proved to be better studenta soholastically than were those studying under the G. I. Bill of Righta but their corpelations between undergraduate and graduato averages vero also higher.

No appreciable difference was observed between the trans* fers and non-transfors except that atudents taking undereraduate vork in colleges where a Phi Beta Tappa chapter was established tended to be auccessful in non-Phi-Beta-Rappa eraduate schools regardiess of their undergraduats marks. This was not true for atudents who took undergraduate work in one non-phi-Beta* Kappa sahool and tranaferred to another auch school for graduate study.

Little value could be placed on the use of undergraduate marks as eriterion for predicting eraduate school success in the vocational or business areas of study, whereas in the field of natural soiences, they could be used with considerable rellability. It was also found that probable graduate success in not contincent upon time-lag factor until at least ten years had passed.

## ACKVONLEDOMEXTS

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## TABLE OF CONTENTS

Chapter Page
I. ter problew of pridicting graduate success FROM UMDEFGRADUATE MARES ..... 1

1. Introduction. ..... 1
2. Statement of the problera. ..... 2
3. Dasis of the study. .......... ..... $\frac{3}{5}$
II. SURVFY OF RELATED IEVESTIGATIONS ..... 8
iIf. trecnicde used in collectina and tbrating dATA. ..... 22
4. Sources of the Data ..... 22
5. Procedure ..... 28
IV. RCSULPS AND INTEFPRTPATIONS. ..... 32
A. Gradempoint Averages for Undergraduate Work and Graduate Work According to Sex. ..... 36
B. Orade-Point Averages for Undergraduate Work and Graduate Fork for kale Vetorans and Non-Veterans. ..... 39
C. Grade-Point Averages for Undercraduate work and Graduate Work for Transfers and Non-Transfers. ..... 41
D. Grade-Point Averages for Undereraduate Work and Graduate work According to General Areas of study ..... 56
E. Crade-Point Averages for Undergraduate Work and Craduate Work According to Time-Lag Factor. ..... 64
 ..... 74
6. Summary ..... 74
7. Conclusions ..... 75
8. Recomsendationa ..... 77
BIBLIOGRAPHY ..... 80
vita ..... 82

## LIST OP TABLES

I. TOTAL KASTERIS DEGREES ORANTED, 1947-148 TERONOA 1951-52, WOMBRA OF CASES USED, AND APPROXIHATE PRECETTAOE OF TOTAL CASES REPRESEETED DY EACII SCGOOL. . ........ 23

III. RELATYONSHPS BETWEEN UNDERORADUATE AND GRADUATE GRADF-POINT AVERAOES FOR 1,543 HALES AND 1.457 fenales 36

IV. RELATIONSHIPS BETKBEN ONDERORADUATE AND
GRADUATE GRADE-POIMT AVERAGES FOR 922
MaLI VETERAMS AND 621 male nOM-VETERANS . . 39
V. RELATIONSHIPS BETEEES UNDERGRADUATE AKD GRADJATE GRADE-POINT AVERASES FOR 1,500 transfers and 1,500 non-Tratsfers ..... 42
VI. RELATIONSGIPS BETPEEA OMDERORADUATE AMD
GRADOATE ORADE-POTRT AVERAOES FOR TWO
DIFFERERT GROUPS-OR TRANSFKRS ...... 4.
VII. RELATIONSHIPS BETEREW UNDERORADUATE AND GRADDATE GRADE-POINT avERAOES POR NONTHAXSFERS ITH UINE DIFYKRENT SCYOOLS .... 47
VIII. MEAZS OF UNDERGEADUATR AND GRADNATE GFADEPOINT AVERAGES FOR NOE-TRANSYERS IN IINE DIFFERENT SCHOOLS COMPAEED MITH TCTAL MON-TRAWSFERS ............ 55
IX. RELATIONSHIPS BETHEEX ONDERGBANUATE ARD GRADUATE GRADE-POINT AVERAGES FOR SIX OERERAL ASEAS OF STUDY.57
X. MEANS OF UEDERGRATJATE AND GRADJATE GRADEPOINT AVERAGES FOR SIX CENETAL AARAS OP STUDY COMPARED WITH TOTAL POPJLATION..... 63
XI. RELATIONSHIPS BATHEEN OMDERGRADJATE AND graduate gradmopoile averages according TO TIME-LAO FACTOM. .............65
XII. EEANS OF UNDERGRADOATE AMD GRADUATE GRADEPOIHT AVERAGES FOR TIME-LAG FACTOR OROUPS accordino to sex conpared mith totals

## CIIAPTER I

## THE PROBLEM OF PREDICTIHO GRADUATE SUCCESS FROY

 UNDERGRADTATE WARKS
## 1. Introduction

Throughout the United States the problem of predicting college nuccess at the graduate level is of major importance not only to the graduate achools but also to the individual. students who might apply for such atudy. The atudents are desirous of knowing their chances or prospects of successfully completing the required courses of study, and the graduate schools are interosted in serving their students, and the public, and themselves in the best possible manner. This sorvice to the publie and the atudents embracea methoda of admission to graduate stuay as well as the aubject mattor taught, the manner of teachings and the innal outcome of the graduate career.

Oraduate achools are not in general agreemont as to which is the best method or selecting their students. Some base this selection upon a battery of achievenent testa, others use a general intelligence test, and still others use various grade-point averages achieved by the indivicual student on his undergraduate program. Although combinations of these criteria exist and are used by the various institum tions, together -ith local supplenentations, probably the one
basic prerequisite ossential for achission to ereduate study is the succesaful complotion of the baceslaureate degree from a soliool of recognized gtanding. This gucoessful completion" procludes a certain grado-point derage in all colleges or universities.

If the edrission gencies in the various graduate achools of the nation could standardine theix seleotion criteria, it probably would be of material benerit to all conoerned. while the various tests rrequently used are otandardied, the college marics are not. Although mark of "B" would seen to indicate the same degree of scholarshis in any two courses taken in college, this is not necesacrily oo. Sot all fieids of atudy within college are of equal difficulty nor in it possible to eliminate all variations in marks subjectively given. The problen of standardisation of marks given in different institutions can be very well handiad on paper, but in effect, it is comon knowledge that tho variation is quite wide.

This lack of standardization of undergraduate marks 18 a major problem in uaing such marks for the prealction of grachate success. Jowever, since it is generally conceded that the basis for the marks both on the undergraduate and graduate levels is primarily the ame, the relationship between such 殂apks should be considerable.

## 2. Statemont of the Problem

Ihis study was initiated to determine quantitatively the rolationship between undergraduate marks and exaduata marks

In selected eraduate schools in Texas. When the relationship was established, various faotors were atualed to find thels part in the trend as a whole. These factors were: (1) sex differences in the total population; (2) veterans as compared with non-veterans in the male population; (3) whether both degrees came from one institution or whether the student took the baccalaureate degree from one Texas institution and then transferred to another for eraduate work; (4) the problem of dotemining whether the possession of a Phi Beta Kappa chapter in achools being transferred from had any offect on the eraduate merica; (5) aifforent areas of acadeaic study: and ( 6 ) a time-lag factor between the two degrese. From a study of the part these various factors pley in the over-all resulta, one could within certain limitations predict probable graduate success from undergraduate marks.

## 3. Basle of the study

The proper officials in all of the white graduate schools In the state were approached with the apecirications of the study and their cooperation in opening their files to the inveatigator was requested. Although few of the achools had a dofinite policy in mainteinine a atrict confidential nature of their studentg marks, most of them were filling to cooperate fully wen thoy reallzed that the work of individual students and the identity of individual schools would
not be compromised. Some nine coeducational schools were selected to participate on the basis of their geographical location; their affiliation with various denominational groups, or the lack of it; their size, as determined by their student enrollment; and the number of master's degrees granted during the school years 1947-48 through 1951-52. In this way, the study included atate-supported schools, some of which wore 'the so-celled "teacher's colleges" whereas others were not churci-supported acioola; and Independent schools.

A total population of 3,000 students was selected for this study to insure adequate numbers in all of the divisions that would be made, and the cases were prorated in accordance with the number of master's degrees conferred during the five years under consideration.

In order that the range of graduate marks would be as large as that for the undergraduate marks, an adjustment factor was applied to the work of those atudenta who did not do highly acceptable work. This application of a quantitative value to a qualitative factor was made in order to make the atudy more meaningful. Further discussion of this will bo found in Chapter III.

When the grade-point averages were computed, various correlations were run to determine the existing relationships. These included the freshman-sophomore grade-point average, the funior-senior eraco-point averages, and the total undergraduate grade-point average as correlated with the graduate
grade-point avorage and the adjusted graduate erade-point average for each of the various factors stualed.

## 4. Limitations of the study

The scope of the atudy was ilmited to a population of 3,000 eraduete atudents who were awarded master's degrees within the past five years. One-half of those took both degrees from the asse institution whereas the other 1,500 transforred from one school to enother Texss achool after the first dogree had beon conferred. Thin sanpling should be ample to make some definite conclusions frara the findinge, but a 'larger sample was available for investigation. The etudy included only Texas etudents in pexas schoola. Any vork on ither the bachelor's or themaster's Cegree in an out-of-the-state school dsquallfiod the student from the ampling. A similar study in other atates would make the investigation a much more inclusive one and therefore of more value to graduate achools in thoir asiection of candidates.

Although no attention was paid to sex or racial extraction of the suaceasful graduste candidates when thoir eelection for thia study wes made, there were no records of Yegroes aveilabie for investigation. Honce, any conclusions drawn in this atudy would not to applicable to Negro achools offering graduate degrees.
only nine of the graduate schools of the state wore selected to participate in the study. The vriter bolloves
that this group was a representstive sampling, both of oolleges and the students selected to participate, but the number could have boen larger and the results more conclusive if all graduate schoola had participated.

The study was kopt on an impersonal basis at all times. Not only were numbers used for the individual atudents but the colleges and universities were also coded. Protecting the 1 dentity of the schools at times astracted from the value of cortain phases of the study.

This study did not include all the college marks of a few students, Some atudents earned far more than 120-128 hours of credit before taking work toward the master's degree. These were usually the students who had taken a baccalaureate degree in the 1920's or carly 1930's, then returned during aucceeding aumsers to take post-gradusto worir, but did not start on any graduate program until a number of gears later. In some instances, the total undergraduate work thus taken amounted to more than 250 semester hours. While this work ahowed on the records, and woula have been avallable for study; it was folt that only the work eamed toward a degree, whetber of a baccalaureate or graduate level, should be atudied in this inveatigation. The study included ilttle more than the marks earned by the various students. There was no study of extracurricular activities, nor were special activities of the atudents in their professional rields given attention.

Other interesting causativo factors, auch as religious manifeatations, ages of the various students, anount os outaido work oarried, socioneconome ractors of ail kinds, and faily backerrounds, were all omittod. Jonos ${ }^{1}$ found that economio factors, including the amount of ramunerative work carried on by students, long with social and physical factors, osn contribute toward prevention of the highest effort expended toward scholastio achieverient.

The lack of stmdardization of teachers: marks throughout the stuay, whether between instructors within one department of aollege, betwaen departments, or betweon institutions, must bo reoognizof and treated as a known limitation.

The value of the atudy woula have been greatig enhanced if there inad boen a sufficiont mumbr of atudents who had worked on or had completed the requiroments for a doctor's dezree as woll as master's dacree, Bowevor, only twenty-five out of the 3,000 casea had done eny eracuate work above mesterts degree, and none had inished the requirements for a doctorate. Of those twenty-five, only aix had done as much as fifteen samester hours of work, and it was rolt that no definite conclusions ooula be dram from auch insurficient data.

The values of this atudy should be considered in the full Iight of such meaknosssa and Ifintations as those pointed out above.

1
Edward S. Jones, "The Orade-Test' Correlation as an Index of Motivation," School and Society, Vol. 36 (October 8, 1932). pp. 479-480.

## CHAPTER II

## SURVEY OF RELATFD INVESTIGATIORS

In makins a survey of the ilterature on the subject of relating one group of marks to another, the writer found that considerable interest had been displayed in this field during recent years, Rost of thase tudies, however, were of ilttie significance to the present investigation.

Segel ${ }^{2}$ coraplled some 135 aelected references in the field of prediction of college succoss. Each of these references was discussed in varying lengths in his study in order to bring the attention of educators upon the work done in the science of testing for the ultinate prediction of college success. Various methods, atatistical and experimental, were discussed in order to make his work more valuable, not as a predictive tool itself, but as a hand* book for administrators and investigators concerned with the problens of college adnission or guidance of college students.

The Oraduate Record Examination, under the direction of the Educational resting Service of New York City, is perhaps the most outatanding test that has been constructed for predioting the sucoess of eraduate students. Its purpose 18 to test knowledge and to correlate this factor with grade-point

[^0]averages oarned by auccessful graduate students. Heston
had the following to say about the Graduate Record Examina-
tion:
In 1937 the Craduate Schools of Harvard, Yale, Princeton, and Columbia Univeraitien ponsored a new testing proeram for graduate etudents. Thia project, dealgnated as the Graduate hecord Examination, was organized in collaboration with the carnegie Foundation for the advanceraent of Teaching. Since ite inception the program has stealily broadened its scope, so that by 1946 a total of 120 graduate and professional schools had taken official action either requiring or recomending the Examination. over 600 centers have now boen established at colleges where accredited Examiners are prepared to make the Examination available to candidates. During the Iiscal year ending July 1,1946 , neariy 53,000 studenta were tested in the various projects cerried on by the oraduate Record office, ${ }^{2}$

Charles $R$. Langrair is one among several who has found that the Craduate Record Examination is not as satisfactory aa erado-point averages in cortain cases. He azys:

At one University the data from the Graduate Record Examinetion proved less satisfactory then the undercraduate record in predieting suocess of a stucent prepared at that same Univeraity. 3
In 1042, Weber, Frink, and G11111and reported:
Up to the present few studies have been reported concerning the prediction of auccess on the graduate level. Kention ahould be made, however, of the work of comittee of the Camegie Poundation for the Advancement of Teaching, of wich Mr . Learned is chairman. This comaittee has constructed a six-hour

2
Joseph C. Heston, "The Graduate Record Examination vs. Othor Znasures of Aptituate and Achievenent," Journal of Fducationsl Research, Vol. 41 (January, 1948): p. 339.
${ }^{3}$ Chorles R. Langmuir, "The Graduate Record Examination," The Carnerte Foundation for the Advancement of Teaching, Thirty-Seventh Ammal Report, 1941-42; p.63.

Graduate Record Examination that covers seven fields of study: mathematics, physical sciences, biological sciences, literature, fine arts, foreign languages, and verbal aptitude. ... These tests have predictive value, but for the most part their correlations with success in the professional schools have not been determined accurately. With the rapid growth of graduate enrollments, the selection of students at the higher levels becomes increasingly important, and this fact is being realized by leading graduate schools. 4

The problem of their investigation was the determination of
the value of several different factors for predicting success
in the graduate school.
Stated in another way, what is the relationship between these factors and marks in the graduate choli The factors considered are: average undergraduate scholarship marks, intelligencetest scores, average undergraduate scholarship maris in the field selected for graduate specialim ration, mount of undergraduate wo gk taken in the field for graduate specialization. 5

The researchers claimed that the study was concerned with
319 students who previously had graduated from the College of Liberal Arts, Northwestern University, and who had completed at least nine hours of graduate work. However, when these students were broken down into fields of study, 116 for humanities, ninety-two in physical sciences, and 108 in social sciences, the figures did not agree. Incomplete records limited the group to 181 when the scholastic average in the major field in which the student continued in graduate work was studied.

4 Janet weber, W. G. Brink, and A. R. Gilliland, "Success In the Oreduste School," The Journal of Higher Fducation, Vol. 13 (1942). p. 19.

5
Ibid., p. 19.

They were also worried about the rellablility of the marking system used, although the atudy was limited to students in one institution.

The rellability of the marking system ia a factor which has been questioned by several inm vestigators who have used marks as a criterion of success. The rellability of the scholastic average can be computed only by assuming that the underlying ebilities remain substantially the aame from term to term and that easentially the same abilities are fequired for success in one term as in another. ${ }^{6}$

But the reliability for the time of the atudy, as predicted by the Spearman-Brown formula, was .94, high enough to warrant the belief that the grade averages represented rellable indices of the students work.

In terme of comparison with the results of the present stuay, their findings were of considerable interest:

Then the undergraduate marks of the 319 persons included in this study were compared with their mark averages in the Graduate School, a positive correlation of 61 was obtained. Since this group of studenta is asiected one, this correlation shows a falriy atrong relationship. Marik averages in the major field correlated .62 with graduate averages, which is only silghtiy higher than that between the undergraduate and eraduate averages an a whole. Horeover, the reletionship between marks in the fiela in undergraduate and graduate work was no closer than between general acholarship averages, also being . 62.7

And when the students were divided into various fields of atudy, they found that

$$
\text { IbId. : p. } 20 .
$$

7 Ibid., D. 21.

Ondergraduate marks in the mumanities were more cloeely related to eracuate marks than in either of the other two fielcs, or than for the group as a whole ( 5 . 66). . For the soclal-acience group the correlation between undergraduate and graduate merke was *52, which is considerably lower than the correaponding correlation for the entire group. . The correlation between undergraduate and graduate mark for the physical-science group was 63.8

Also of importance to the present atucy was their final conclusion. It was:

The finding of multiple correlations between the various factors, it wil be noticed, ild not eive correlation which permit more accurate prediction than the best single measure, namely, undergraduate marks. 9
From 1942 through 1946 Seagoe used the National Teachers: Examination at the Dniversity of California at Los Angelea for predictive purposes when ahe dealt with doctoral students In education. She was not pleased with her criterion and made the taternent:

In the first place, the examination 18 deaigned to measure the informational aspects of teacher preparation, not aptitude ror avanced Eraduate work. Although there is eood reason ror belioving the two purposes have much in comon, they are not identical. 10

She concluded:
The National Teachers' Examination has ereatest predictive value on the Qualifying Examination in paychology, and significant value for philonophy and history. It has little predictive value for adminiseration on the basis of the data given. 11

> | 8 Ibla.: |
| :--- |
| 9 Ibla., 22. |
| .24. |

10 hay $\nabla$. Seagoe, School of Fducation," 1949). p. 89.

11
IbId. p. 91.
cook ${ }^{12}$ had previousiy worked with 788 students at the College of Education, Univeraity of Minnesota, in 1940-41, where he used three criteria of success in graduate works (1) honor-point ratio based on letter grades in all graduate courses taken by the atudent; (2) numerical acores of atudents in various gracuate courses, the scores being those upon which the final lotter grades in these courses were based; and (3) numerical scores on graduate comprehensive examinations administered. However, Cook later made the statement:

The first criterion, honor-point ratio, was not used because previous atudies had shown the distribution to be skeved, and the variability inadequate to provide a good criterion measure. 23

He did Ind that the grade-pointa exped by undergraduates were lower than those earned by graduate atudents and the honor-point ratio based on letter erades was not aufficient for hia use at the University of Minnesota.
since it dealt with one of the graduate schools in Texas, a study by wentzil was of particular interest to this investigation. Ee used 200 of the available 752 cases who had cornpleted both their undergraduate work and graduate work within that institution from 1937 through 1949. Wentz used four

[^1]basic correletions between grado-point averages to develop his atudy: (1) between the freshran-sophomore group and the graduate groups (2) between the junior-senior group and the graduate group: (3) between the major-subject and the graduate group; and (4) between the total undergraduate group and the graduate group. Another investigation was made using a abbgroup of fifty-five from the orlginal 200 who had taken the American Council on Education Paychological Examination and the Cooperative Finglish Test as freshmen. Correlations were computed for this aub-group between the Tascores made on the American Council Paychological Examination and the graduate grade-point averagea and between the T-scores mede on the Cooperative English Test and gracuate grade-point averages, and then another was computed to find the relationship between the total of those two T-scores with the graduate srade-point average.

A third investigation was made with reapect to 95,953 grade marks eamed by undergraduate students and the gradepoint average of the master's degrea graduates and a comparison of the 95,953 grade marks earned by undergraduate studenta and the undergraduate major-subject of the master's degree graduates.

Wentz obtained the rollowing Pearson product-moment correlations in the four basic sets of variables: (1) .46 between grade-point averages for freshman-sophomore work nad graduate work: (2) 42 between grade-point averages for
junior-senior work and graduate work; (3) . 46 for grade-point averagea for major-subject work and graduate work; and (4) . 46 for erade-point averages for total undergraduate work and graduate work with a probable error in each case or . 04.25 Regression equations for predictive purposes were then worked out to estimate the probable grade-point average that might be earned in the graduate school ron a consideration of the major-aubject grade-point average. Decilea of their averages were alao calculated, and the median of the grade-point averages of the mejor subject was round to be 2.80 .

This figure indicates that of those students who have been successful in obtaining their H. A. degreo from this institution half have had a grade-point average of less than 2.80 in their undergraduate academic najor aubject. It would also indicate that only one out of five had major-subject grade-point average of less than 2.31. or one might interpret it to mean that only 10, or one out or ten studente, have ever received an $\mathrm{H}_{\text {. }}$. $A$. degree from this institution With a erade-point average in their major subject of loss then 2.08 (better than a c' erade). This ecale is extremely important to this study, and it is significant that the percentile points rall at such a high level. It can bo sald that only thirty out of a hundred have over been awarded an w. A. degree with a grade-point averace of less than 2.47 in their undergraduato qcademic major subject. 16

Regression equations were also constructed to estimate the probable erade-point average that might be earned in eraduate school from a conolderation of the grade-point averages of the total undereraduete work. About this he sald:

Ib1d., p. 29.
16 Ibia., pp. 37-38.

- . those studenta earning in excess of 3.80 in undergraduate work ( 3.60 for undergraduate major subject) did not achieve so hizh an average in eraduate work. In other words, it would appear that the superior student does not do as well as the poor student when comparing the rate of difference between grades in undergraduate work with graduate woric; the superior student goes down wille the mediocre or poor student goes up. Thore aearas to be no known explanation of this phenomenon outside of apeculation; while this etudy does not take into consideration the many factors mentioned under the llaitations of the atudy, it was of interest to attempt to explain some of the factors which might affect one phase of the phenomenon. 17

One of the factors contributing to the sudden junp in grades from undergreduate achool to graduate school was particularly Interesting:

- . an arbitrary mariking syatem of only three passing marka-A, $B$, mo C--is provided in the eraduato echool in contrast with a markine systea of four passing marks-A, $B, C$, and $D--i n$ the undergraduate school. Although the original intention of this three-mark grading systera was to insure higher accomplishment of graduate students, the actual result may have been, in part at least, to cause instructors to revise their plans of assigning marise to sraduate students. 18

Fente found that the coefficients of correlation between the various test acores and creduate work fell considerably below those showing the relationship between undergrsduate and eraduate work. These coofficients were found:
between the American Council Psychological Examination and graduate work, 30 with a probable error of .09; (2) between the Cooperative English Te at and graduate work, . 20 with a

$$
\begin{aligned}
& 17 \text { Ibid. : D. } 41 . \\
& 28 \text { Ibid. P. } 42 .
\end{aligned}
$$

probable error of .08; and (3) between total test acores of the above and graduate work, 33 with a probable error of .08. 19 Because the correlations were so low, it was felt that the angle of inclination would be inaccurate for making predictive regression lines.

The other investigation undertaken in the stisdy would prove of 12ttle value to the present research, but some of the concluaions drawn are shown below:
(1) The total grade-point average earned by undereraduate students affords depondable indiela from which criteria could be established for predicting probsble success of students in the Graduate School. It is probable that if a student makes a total undereraduste grade-point average of at least 2.58, he would sueceod in graduate achool, provided further that thore existed no erratie gredes.
(2) The academic major aubject arfords a better tool than does the total undergraduste grads-point average for the purpoces of predicting probable success. If a atudent has a crade-point average In his major academic aubject or more than 2,82 the chances are about one to one that ho would make a good graduate student; whereas, if his major aubject everage 13 2.39, the chances would be about one out of four againat him.
(5) The requirements of an average of $B$ and a minimum credit mark of $C$ in the eraduate chool appear to have resuited in a double standard of marking. 20

The figures given in the above study are comparable to those of the present atudy inasmuch as the grade-point averages were obtained in the same mathomatical manner.

19 Ib1d.: p. 46.
20 Ib1a.. pp. 63-64.
aarlington ${ }^{21}$ pointed out in 1342 that arado-point avorages earnad by high school studenta were not a suitable criterion for adjudicating the probable succese of college freabmon in that same institution. she rurther pointed out that there was a gep between high achool ma oollege and egain betweon college and college graduate work, indicating perhaps that oolloge gradepoint merages might not be completely velid tool in building criterie for predicting suocess of graduate students.

In 1949 Jonson at the Jniveraity of Fittsburgh atated:
The problem of deterraining wich applicants for Eraduate atudy have the best charcea of qualifying, for advanced degree han troubled graduate sohool administrators for meny jears. few institutions conducting research long these lines have isolated soae of the verlables which have helped considerably in predicting graduate scholastio achievement. But the improvement in accuracy of predicting scholastie success at this level of training has boen alow and at best it is far from perioct. Even if it were perfoct the real relationships between grade-oaming power and later success is not clear-cut. It is generrily recognized that meciemic nchievements leading to the acquiaition or advanced degrees do not invariably sienify poatdegree world-shaking accomplishante. Perhaps a lack of uniformity in standards of selection and training mong graduate schools accounts for much of this apparent diserepency, At present, however, cholarship constitutes the most widely used and most generaliy understood criterion of future attainment. Eence. acceptable course marks becone our immediate criterion of graduate student promise and hoperul sign of subsequent ecientific and professional attainments. 22

21 Glacys Ryen Garlington, Persistence of the 1935-36 Froshan of the Southwest Texas State Teachers Collese, Unpublishod haster 's Thesis, Southwest rexas State Teachers College, San Marcos, Texas, 19142 , $p$. 14.

> 22 Ralph 5. Jenson, procicting Scholistio Achievement of First-Year Graduate Students Unpubilshed Doctoral DissertaETon, Vnlversity of PItEsburgh, Pittaburgh, Pemasivania, 2949. p. 3.

His atudy was an attempt to predict the acholastic achievement of several groupa of first-year graduato atudents at the University of Pittsburgh. The major problems under investigation In his study were: (1) investigating the differences in performance on tests of eraduate ability and over-all undergraduate quality-point average of graduate groups in Education, English, Chemistry and Psychology: (2) ascertaining the magnitude of differences in quality-point everages of the groups named above; (3) determining which prealctive variables, singly and in various combinations, give maximum aocuracy in forecasting firat-year graduate soholastic achievement of each group; (4) comparing undereraduate quality-point everages with the tests of graduate ability for accuracy in predicting rlrat-year graduate everages of the groups; and (5) developing devices mereby the resulta may be applied to "actual graduate selection problems faced continually by adralssion officers. ${ }^{23}$

Pinally, rather than devote a portion of the study to the prediction of sholastic achievement for 'general' graduate atudents, the plan of the study is simed at departmental studies. It seems more resilstic to look for separate prediction formules for various flelds of graduate work since the evidence reported points to difforent patterns of ability and educational backgrounds for each. 24

The departmentel samples selected for atudy constituted those having approximately fifty or more students with complete and usable undergraduate recorde and tost acores. all

> 23 Itia.: p. 6.
> 24 Ibia. : p. 21.
their graduate work was taken in one fleld of study at the University of Pittsburgh, and they were tested on the Pittsburgh Exasination during the fall of 1947 or tho spring and sumer of 1948. Two predictive variables were used: (1) the over-all undergraduate quality-point avorage; and (2) the University of Pittaburgh Exaination for Graduste Students, which was battery of three published atandardized tests, namely, (a) uiller Analogies test; (b) Iowa Kathematical Aptitude Test; and (c) The Cooperative Reading Comprehension Test.

Jenson arrived at the following "general conclusions":
(1) Given a set of predictive measures from which it is desired to predict success in graduate scholastic achlevement of different gracuate groups, equal powers of prediction should not be arbitrarily asaigned to each or any combinations of these variablea. Empirical tests should be made first to ascertain differences in group performance on the predictive and criterion variables and beta weights derived for each member of a predictive tean.
(2) Undergraduste quality point averages should not be consiatently relied upon as the best aingle predietor of first-year eraduate acholastic achievenent. Even though it occurred most frequentiy in multiple predictions it should be assigned a weight in reiation to its true power of prediction when the influence of other meabers of the predictive team of which it was a partielpant is excluded. when used singly it should be omployed uith knowledge of ita real predictive power.
(3) In qeneral, the GQPA [qraduate quality Point Aversge] of first-year graduate atudents in Education, English and Psychology can be predicted accurately two times out of three within an error of about three-terths of a quality point in either airection of the best prediction GQPA. This error runs about four-tenths for the Chemistry eroup.
(4) Tho Pittsburgh Examination will proaict graduate success of the groups atudied as woll or better than the much longer tests of the Graduate Record Examination will prodict it far the ame classes of students at Haward or Iowa, 25

Wentz pointed out that
Host collegea and unlversitien use the regular methods of atatistical teohniques of makine studies within their institution for correlatios erade-point averages of undereraduates with grade-point averagea of eraduate tudents. The information gleaned from suoh study is considered only of locel interest and it is not ordinarily made known. Thon, too, the inm formation is usually of a very informal nature, and in that form, while perfectiy suitable for the noede, it is not in the nature of documented deta. 20

It is therefore difficult to obtain rom graduate sohoole reliable information in documented form that would be acceptable to include in atudy of this type. This difficulty does not lessen the need for such Information, however, for often one institution desires to compare the success of ita students with that achieved elsewhere. And, as pointed out before, the problem of selecting worthy applicents for graduste atudy is not new to the colleges of this nation.

25 Ibia. pp. 109-110.
26 George $\mathrm{m}_{*}$ Wentz, Jr* on. oit., pp. 17-18.

## CHAPTER III

technique used in collecting amd treating data

1. Sources of the Data

The data for this study were taken from several sources. First of all, it was necessary for the writer to determine how many masterta degrees had been eranted during the past five jears by the nine schools being considered. Wen this was done, an approximate pro rata share of casea was decided upon for each institution, with the exception of number five. llere, although the number of degrees granted wes less than three per cent of the total, 150 cases were selected as a minimua, since one-half this number would reduce the smallest population with which to work to geventy-tive students. Table I shows the nunber of master's degrees granted by the various institutions during the school years 294-48 through 1951-52, the number of cases selected for etudy, and the approximate percentage these cases represent of the total population of the investigation,

## TABLE I

total masteris dicraes gramted, 1947-48 tinovar 1951-52, WUMBER OP CASES USKD, AND APFROXIMATE PERCEMTAOE OF TOTAL CASES REPRESENTED BY EACH SCHOOL

| School <br> number | Murber master's de <br> Erees conferred | Cases <br> used | Approximate percentage <br> of total cases |
| :---: | :---: | :---: | :---: |
| 1 | 1,622 | 400 | 13.333 |
| 2 | 2,135 | 550 | 18.333 |
| 3 | 2,686 | 650 | 21.667 |
| 4 | 818 | 250 | 8.333 |
| 5 | 294 | 150 | 5.000 |
| 6 | 713 | 250 | 8.333 |
| 7 | 839 | 250 | 8.333 |
| 8 | 728 | 250 | 8.333 |
| 9 | 700 | 250 | 8.333 |

Only the achools' arbitrarily asalgned numbers were used throughout the atudy to protect the icentity of these schools. At no place on the information cards was the name of the school or the neme of the individual etudent used; code numbers took their places.

In each achool the complete list of successful master's degree cendidates for the years being studied was compiled. From this list it was atemined which graduatea were to be
considered merely by taking every third or fourth student. depending upon the number of cases to choose from and the number of cases needed from that institution. After these names were assembled, the permanent records of the various regiatrars were opened and the following selection criteria were then applied: (1) the student must have majored in the same field on both degrees, or if he had majored in more than one subject on his baccalaureate deeree, the eraduate major must also have been one of those flelds; (2) all undergraduate work nust have beon completed without transfer work; (3) rejection of any atudent whose baccalaureate degree was from an out-of-the-state institution; and (4) one-half of the cases selected must have been those who had transferred to another college after the first degree and one-half must have been those who took both degrees from the ame school. This last criterion prevented the sampling frombeing as random as desired, for as the students were Inaliy selected for inclusion in the etudy, frequently more transfers were found then those who had taken both degrees from the saine school, or vice versa. Consequentiy, some of the students, who otherwise would have fitted in, had to be rejected in order not to exceed or fall short of the fifty per cent ratio of tranafers.

Noxt, it was necessary for the writer to obtain the raw letter marks from the permanent record cards of the 3,000 students who hed taken their master's degrees from the nine

Texas Institutions considered. For 1,500 of these graduates Who had taken the baccalaureate degree in one fexae achool and then transferred to another school in Texas for the master's degree, it was necessary to obtain raw letter or number maxik from their transeripts.

A "key" to the names of schools and a separate "key" to the list of studenta within ach school wero kept in order to avold duplication and to enable the writer to find a particular record later if it were eecidentaliy left income plete.

The information recorded for each atudent wes (1) college number, (2) atudent number, (3) sex, (4) birthday, (5) whether he had attonded any part of his schooling as a veteran as derinod by the 0 . I. Eill of Aights, (6) acsdemic major, (7) which undereraduate degree, (8) when taken, (9) where eranted, (10) which mastor's degrees (11) when taten, (12) which doctor's degree, (13) when taken, and (14) a tabulation of the number of "A's," "B's," "C's," "Dta," and "Fis" attained. There was also a line for "totals" and another for "averages." The tabulation was dividod into the following classifications (1) "Preshmem-sophomore," wherein the first sixty to seventy houre of credit carned chronologically were placed; (2) "Junior-aenior," wherein the semainder of the undergraduate work up to the granting of the first degree rell: (3) "total undergraduate," which was merely a total of item one and two above; (4) "major," which included only those marks carned

In the atudent's acadenic major field as detemained by both cegrees; (5) "master's;" wherein all graduate worik leading to the master's degree was recorded; and (6) "doctor'g," which was used only for the twenty-five cases who had completed some work toward their doctorate. After each of these classification colurans, there appeared a "Total" column, which was later used to show the total number of quality-points allowed for each mariz in the various classifications.

Fach atudent's college mariks were tranamuted into qualltypointe by lotting an "A" represent four quality-or gradepoints: "B" threo: "C" two; "D" one; and "F" zero. All grades of "p" or "Pass" or "Credit" were arbitrarily asaigned the mark of "B" and were so considered in further calculatione. From the number of aymbols earned, the proper quality-point Value we multiplied to achieve tho number listed in the "Totel" colurans uncer the various clasaifications. All quarter or term houra were also converted into semester hours and the information recorded on the basis of three semester hours counting as one courae.

When the conversion of mariss into quallty-points was completed, the number of courses and the number of qualitypoints carned were added, end the former was divided into the latter to find the grede-point averagea for the five or six aifferent classiflcations (the number depending on whether the student had finished any coctoral work).

Two other quantities wore then ascertained for each student and entered on the inforaation cards. These were the number of years between the granting of the two degrees, derived aimply by subtracting one date from the other, and the "adjusted graduate grace-point average." This adjusted Eraduate grade-point average was assigned to oach card in order to make the study more meaningrul inasmuch as it was an attempt to give quantitative value to qualitative factor. It was derived by applying penalty to the regularly caloulated grade-point average if the student's graduate record indicated that he did not achleve the marks nomally expected of graduate atudents. This penalty was made up of several parts: (1) if the student made no "A's" on his gracuate record, his average was penalized two-tentha of a erade-point; (2) if he made two times as many or more "B's" as "Als," he recelved the same penslty, but he could not be penallzed for both "(1)" and "(2)"; (3) for a first "C" the penalty was one-tenth of a grade-point; (4) two-tenthe of a erade-point were deducted for each additional "C": (5) for each "D" in the record two-tenths of a grade-point were deducted! and (6) two-tenths of a grado-point were deducted for each "F" recorded. Other then the exception mentioned above, eah orfense constituted a separate penalty, whioh brought the averages of a number of the atudents who barely maintained a required "g" average for graduate work dow to rather low averages.

This adjustment factor gave a greater range to the graduate grade-point averages than existed for the undergraduate marks and therefors tended to correct any degree of skewness that might otherwise have been evidenced on the graduat acale. Thereas the graduat grade-point averages ranged from 2.44 to 4,00 quality-points before the factor was applied, they ranged from 0.54 to 4.00 quallty-points after being adjusted. In every oese, through all the divisions, the correlations are show between the various levels of the undergraduate grade-point averages and both the regular and the adjusted eraduate grade-polnt averages.

## 2. Procedure

With these data at hend, the actual atudy of their relationship to each other was begun. This called for the computation of a series of 234 coefficienta of correlation through the use of scattergrams in order to deterains whether any two of the eets of data under consideration were related, and to what extent the relationship existed.

The Lormula used in the computation of all Pearaon productmoment correlations given in this investigation was the one given by Holzinger ${ }^{1}$ as most convenient for grouped datay

[^2]$$
\underline{m}=\frac{\sum f_{x y} d_{x} d_{y}-\frac{\left(\Sigma f_{x} d_{x}\right)\left(\sum f_{y} d_{y}\right)}{N}}{\sqrt{\sum f_{x} d_{x}^{2}-\frac{\left(\Sigma f_{x} d_{x}\right)^{2}}{y}} \sqrt{\sum f_{y} d_{y}^{2}-\frac{\left(\sum f_{y} d_{y}\right)^{2}}{d}}}
$$

When it was found that a relstionship did exist between undergraduate and graduate erade-point averages; the possible causal relationsbip of various fectors affecting the over-all correlation was determined. That is, it was determined how well one oan predlet from undergraduate work-at the freshmansophomore level, at the junior-senior level, and then at the total undergreduate level--the success graduate students might onjoy.

Then varlous factors were studied to see what effoct they had on this relationship at these thee lovels. Pirst, the matter of sex difference of the acholastics was investicated. Then, anong the malea only, the factor of beling a vetersn or not being a veteran was studied on the three levels and with regular and edjusted eraduate erade-point averages to see if this caused a shift in the correlations. the female veterans were omftted from this part of the study since there were only twenty-elght of them; to have included the females would merely mean that the records of the males were again pitted against those of the females, thereby rendering the veteran factor invalid.

Next, the factor of transfering came in for investigation. The same correlations--between the undergracuste erade-point
averages at the thre levela of work and the regular and adjusted graduate grade-point averages-owere deternined for those students who had transferred after receiving their flrst degrees. These transferees were then divided into two Eroups: (1) those who had attonded achool for their first degree whore a Phi Bota Kapya chapter was establishod and then trensforred to a non-Phi-Beta-Kappa school; and (2) those who had attended a school where no such chapter was eatablished for thelr flrst degree and then transferred to another school whare there was no such chapter. The authority to establlah and the obility to maintain such a Phi Bota Kappa chapter on the campus was arbitrarily selected to denote a widely recognized superior quality among the achools of the nation. Only three such chaptera exist in Texas at the present timo. The atudents who had taken both degrees from the same institution, or the somesiled "non-transfers," were studied as a group of 1,500 , and then they were divided into the various nine schools and the ame correlations were determined for sach school studied. The population for these partioular correlations was one-half the total number of casea selected from each achool. The population for theae individual school correlations therefore ranged from seventy-five to 325. The 3,000 cases were then divided into six general areas or study with no reforence belng made to any other factor. This aiviaion provided 179 casea for the vocational majors,

167 casea for natural sciences, 145 in business, 309 in humanities, 257 in social sciences, and 1,943 in education and health \& physical education. The sane levels of undergraduate grade-polnt averages and the two typea of graduate erade-point levels were then correlated as in the study of other factors.

Finally, on investigation was mede to determine if the length of time betreen the awarding of the baccalaureate degree and the master's degree was of eonsequence to the over-sil relationship. All of the cases were divided into the following five groups to consider the relationship between undergraduate and graduate grade-point averages: (1) no lag through two jears; (2) three through five years lag; (3) six through ton years lag; (4) eleven through twenty jears lag: and (5) over twenty years lag. Thon these groups were divided acoording to sex to see what offect, if any, this factor had on the time-lag variable.

Three well-known sbbreviations were used in the reporting of the results of the investigation: (1) $\mathbb{I}$ for the number of cases used; (2) $x$ for coefficient of correlation; and (3) P. For probable error.

## CHAPTER IV <br> RESULTS AND INTERPRETATIONS

Since all of the results of this study will be given as e coefficient of correlation with its calculated probable error, it is best first to have some understanding of the possible meaning of this coofficiont and an interpretation of its possible magnitudes. Garrett atates:

The productmoment coefficient of correlation may be thought of essentially as that ratlo which expresses the extent to which changes in one variable ere accompenied by-oor are dependent upon--chaneses in a econd variable. 1

Crawford and Burnhon, in the Eirst volume of a proposed exhaustive tucy of the subject, say:
relationship. to .19 denotes indifferent or negigible r from . 20 to .39 denotes low correletion; present but-s11ght.
rfron 40 to .49 denotes a reasonable, and probably algnificent correlation.
$r$ from 50 to .69 denotes aubstantial or marived relätionship.
from .70 to 1.00 denotes high relationship. selcom round, because of complicating factors and uncertain measures. ${ }^{2}$

Rugs eives us a little different interpretation on the ovaluation of coefficionts of correlation when he eajsi

This definition of linits copends largely on the personal experience of the person making the interpretation. For example, it hes been comion for certain educational investigators to arbitrarily

[^3]interpret a coefficient of .25 as an indication of inigh positive correlation, and one of 40 as very high, pothers would interpret. 25 as very low, and. 50 as 'marked or 'somewhat hish,' cortalniy, our educational conclusions mast be colored by our arbitrary derinition of such a coefficient. The experience of the present uriter in examining many correlation tables has led hin to recard correlation as negligiblet or indifferent when $F$ is iess than. 15 to $20 ;$ as being 'preaent but $10 w^{\prime}$ when reranges rrom. 15 to 20 to 35 or 40; as beins 'markeaty present or marked, ' when $\underline{F}$ ranges froxa 35 to 40 to 50 or 60 ; as being inight when it is above $60^{\circ}$ or $70^{\circ}$. with the present 11mitations on educational tostins row correlations in teating will run above 70 end it is safe to regard this as a very high correlation. 3

Tablo II gives the coerficients of correlation and their probable errors for the total population of 3,000 cases.

## table II

RELATIONSHIPS BETWETM UTDERGRADUATE AND GRADUATE GRADE-POTMT averades for 3,000 texas cases

Relationships
(1) Grado-point avorages for freamansophomore work and Eraduate work
(2) Grade-point avorages for juniorcenior work and graduate work
(3) arade-point averages for total underEraduate work and eraduate work
(4) Cracempoint evorases for freshmansophomore work and adjusted graduato work
(5) Grade-point overages for juniorsenior work and adjusted craduate work
(6) Grade-point averazes for total undergraduate worts and adjusted graduate work
.435
.010

[^4]It is ovident that the grado-point averages for the three different levels of undergraduate study are of approximately the same value for prediction purposes. Using Rueg's "experience" as a criterion for eeneralization, one would asy that all of the above coofficients show that the relationship between undergraduate and graduate grade-point averages, and between undergraduat and adjusted graduate grade-point averagea, were "markedly present." The above resulta were extremely close to those obtained by wentz 4 in his atudy or 200 oases at only one Texas college, but were lower then those obtained by Weber, Brink, and Gilliland, ${ }^{5}$ who studied 319 students at Hortheatern Oniversity. It in interesting to note that the coefficients of correlation did not follow the results of Strang, who sald:

As cortain students become more and more ongrossed in their major interest, they tend to devote an in ereasing amount of effort to it with a resulting neelact of other courses. ' This specialization of interest may bo the most important factor in lowering the goefricient of correlation in the later years of college. 6

The relationship between junior-senior grade-point averages and eraduate woris was higher than that for the freehman-aophomore work before and after the adjustment factor was applied, although the application hoightened the difference.

[^5]It is intereating to note that the junior-sonior work was the beat of the three indices to use in both cases and the total undergraduate averages were the poorest, although when the graduate averages were adjusted, there was no practical difference between the use of the freshman-sophomore averages and the total undergraduate averages.

In any event, for predictive purposes it would seom that ell the grade-point averages taken could profitably be used as worthy indices. The coefficients fell at both the freshanm sophomore and the funlor-senior level of the atudy when the adjustment factor was applied to the graduate grade-point averages, but rose slightly at the total undergraduate work level.

In later discussions concerning the magnituce of the coofficients of correlation obtained for the various factors under consideration, little will be seid unleas those coeffioients are oonsiderably above or below the ones found in the over-all relationships between the three levels of undereraduate marks and the graduate grade-point averages.

The junior-senior grado-point averagen were more than three-tenths of a Exado-point hifher than the freshman-sophomore averages, having meens of 2.989 and 2.623 respectively, while the mean total undereraduate grade-point average was 2,810 . The adjustment factor brought the graduste grade-point everase down from 3.467 to 3.394 .
A. Grade-folnt Averagea for Undergraduate work and Gracuate Fork According to Sox

When the selection of the 3,000 cases was finlshed, the writer was surprised to find that they were so nearly equally divided botwoen males and fomales. There were 2,543 malea and 1.457 females, representing 51.43 and 48.57 per cent of the cases, respactively. Table III below shows the same sets of data as those given in Table II, but divided into the two sexes.

## TABLE III

RELATTONSHIPS BETWEEX UNDEFGRADUATE AND GRADUATE GHADE-ROIXY AVERANES FOR 1,543 wALES AND 1,457 FEUALES

| Relationshipa | Hales |  | Femalas |  |
| :---: | :---: | :---: | :---: | :---: |
|  | 5 | P. E. | $\mathbf{r}$ | P. $\mathbf{F}^{\text {\% }}$ |
| (7-8) Grade-point querase for Ireshan-sophomore worls and Eraduate work | .427 | .014 | .658 | .010 |
| (9-10) Orade-point averaces for Junior-senior woris and graduate work | . 505 | .013 | .453 | .014 |
| (11-12) Gradempoint everages ror total undergraduate vork and eraduate work | . 147 | .014 | .418 | .015 |
| (13-14) Grade-point averages for freshman-sophomore work and adjusted craduate work | .396 | .014 | .627 | .011 |
| (15-16) arade-point averages for junior-senior work and adJusted Eraduate work | . 462 | .014 | .420 | . 015 |
| (17-13) Grade-point averages for total undergraduate work and adjusted graduate work | .439 | .014 | .386 | . 015 |

The coefficients of correlation for the males followed the same ceneral pattern as those for the total population with the exception that with the malea the gradempoint averages for the total undergraduate work proved to be a better criterion for prediction than the freshmen-sophomore grade-point averages. Rere, tho adjusted graduate work averagea consistently showed a lower relationsinip than did the eraduate work averages before they were adjusted.

An unusual phenomenon appeared in table III. The rolationship betwoen the grede-point averazes for freshman-sophomore work and graduate work, both regular and adjusted, for the fenales was quite high. Berore the eraduate worli was adjusted. the coorficient was the second highest in the entire study, and it waa elenificantiy higher than that for the seme sets of data for the males. It was, according to Rugg's atendards, "high" rather than "marized,"7 and was the aecond highest the writer was able to find in his survey of the field. The relationahip between the other two levela of atudy and the graduate marics were not marisedly different from those found for the males, and the altuation was made all the more unusual when one discovered that otherwise the coerficiente for the females trailed those for themales in every case. Here, for the firat and one of the few times, the aituation decidedy followed that referred to by strang, ${ }^{8}$ and showed that among

7 Harold O. Ruge, loc. e1t.
${ }^{8}$ Ruth Strang, 10c. c1t.
the females the freshman-sophomore erade-point average was a zuch better criterion for the prediction of eraduate chool marks than was the funior-senior or the total undergraduate work. This could have been caused by the reasons given in the above reference or possibly the fact that females were more interested during the latter two jears of their undergraduate career in extrawcurricular duties and pleasures then thoy were in achieving good marks. The oppoaite was posaibly true during their firat two jears of college study. This indicatod that the objectives of undergraduate remale students In Texam changed after the first two years of acadenic ifo. The other coerficients of correlation for tho fomalea showed no perticular deviation from those found for the population as whole. That between the total undergrachate work and the adjusted graduate work dippod below. 40 for the only time in this part of the investigation, but was not aignirlcantly lowar than the others.

A comparison of the mean acores throughout the data for the males and females revealed no significant differences for Oither group. The mean freshman-sophomore grade-point average for the males was 2.562 , while that for the fomales was 2.679 : on the junior-senior level, the means were 2.946 and 3.033 respectively and on the total undergeraduate acores they were 2.754 and 2.865. The mean graduate grade-point averagea for the feanales were consistently slightly higher then those for the men, being 3.526 an compared with 3.473 before the adjustment and 3.439 and 3.349 aftorwards.
B. Gradeupoint Averages for Undereradunte Fork and Gracuate Worl for Nale Veterans and Hon-Veterans

When the males of this atudy were further diviced into the categories of vetorans and non-veterana, it was round that 922 or 59.75 per cent were veterans, as olassifled by the G. I. E111 of Righte, and 621, or 40.25 per cent, were not. The ame statistical procedures were applied to these two groups, and the resulta are shown in $T a b l o$ IV.

## TABLE TV

GELATIONSEIPS BETEEEN UNDERGRADOATE AND GRADUATE GRADE-POIXT AVEFAGES FOR 922 HALE VETERANS AND 621 MALE NON-VETERAKS

| Relationships | Veterans |  | Yon-veterans |  |
| :---: | :---: | :---: | :---: | :---: |
|  | \% | P. E. | F | P. E* |
| (19-20) Grade-polat averages for freshnnan-sophomore work and graduate work | . 418 | . 018 | . 439 | .022 |
| (21-22) Orade-point averagea for junior-zenior work and graduate worik | . 472 | . 017 | . 566 | . 018 |
| (23-24) arado-point averages for total undergraduate woris and graduate work | .413 | . 013 | . 513 | . 020 |
| (25-26) Grade-point averages for freshmun-sophomore work and adjusted greduste work | . 389 | . 019 | .423 | . 022 |
| (27-28) Grade-point averages for junior-senior work and adjusted graduate work | . 440 | . 018 | . 529 | . 019 |
| (29-30) Crade-point averages for total undergraduate work and edjusted graduate work | . 406 | . 019 | . 501 | . 020 |

Although one may have heard much about the serlousneas and maturity with which veterana attacked their school work when they returned to civilion iffemhow they knew what they wanted and went arter it rather than "playing around" 2s the non-veteran had a'tendency to do-the above figures dia not in any instance bear out this "auperiority." In fact, the reverse trend was indicated by every coofficient and when the mean erade-point averages were considered, the picture was even stronger in favor of the non-veterana because all averages for veterans were lower than the corresponding averages for non-vetorans. The means presented below give the veterans first and then those for the nonveterans: freahman-sophomore grade-point averages, 2.546 and 2.587, junior-senior grade-point averages, 2.936 and 2.951; totai undergraduate grade-point vorages, 2.749 and 2.762; graduate grade-point averagea, 3.465 and 3.483 ; and adusted grade-point averages, 3.343 and 3.366.

Approximately the ame predictive value could be attached to the freshman-sophomore work for both groupa, but the difference in the second half of their coilege work was quite derinite. When the djusted graduate work was con* sidered, the values were not materially changed.

The lower relationshlps for the veterans may be due to one or a number of causes, among which are the following; (1) voterans hed varied their interesta while in service and bence did not want to be tied dom to the eingle goal
of graduate study; (2) a armory examination of the marital status indicated that larger percentage of veterans were married than were the non-vaterans; (3) the average age of the veteran student was between three and four years higher then that of tho non-veteran, during which time the learning processes had slowed; ${ }^{9}$ (4) some veterans went back to school simply because the government would pay part on all of their expenses and they had little or nothing else to dos (5) some veterans congregated in apecinl actions of courses with "extra" and possibly inferior instructors assigned to thea; and (6) many veterans who wee not fItted for college training or who normally would never have had the financial opporm tunity to attend started a college career with veterans" allowances.
C. Grade-Point Averages for Undergraduate Fork and Graduate Work for Transfers and Hon-Transfers

When the records for this study were gathered, one of the selection criteria was that onemalt of the cases would be transfers, es previously defined, and the other one-half would be nonwtranefers. Table $V$ gives the results of the correlations computed for the st two large groups.

[^6]
## TABLE Y

RFLATIONSEIPS EETTERN UKDERORADUATE AND GRADEATE GRADE-POIFT AVERAGES FOR 1,500 TRANGEERS AXD 1,500 HON-HRAXSFERS

| Relationships | Transfers |  | Non-tranafers |  |
| :---: | :---: | :---: | :---: | :---: |
|  | $\boldsymbol{r}$ | $P \cdot E_{\text {c }}$ | シ | 8. E* |
| (31-32) Grade-point averages for freshuan-sophomore work and Eraduate work | .427 | .014 | .448 | .014 |
| (33-34) Grade-point averages for juniormenior work and eraduate vork | .466 | .014 | .480 | .013 |
| (35-36) orade-point averages for total undergraduate work and Exaduate wrla | .516 | .013 | .498 | .013 |
| (37-39) Grade-point averages ror Treshanan-sophomore work and adjusted Eraduate work | .393 | .015 | .435 | .014 |
| (39-40) Grade-point averages for junior-senior work and adjusted graduate work | .415 | . 014 | .453 | . 014 |
| (41-42) 0rade-point averages for total undergraduate mork mid adjusted eraduate work | .423 | . 014 | .494 | .013 |

The Eimilarity of the two Eroups was momewhat gurprising and indicated that it made ilttie or no appreciable difference whother one transforred to a second school after taking the bachelorla degree or stayed in the ame achool for the two degrees. The non-transfers hed slightiy higher correlations on both the freshmen-sophomore and the junior-senior work but fell below the transfers on the total undergraduate
correlation; howevor, the non-transfers were higher on all three lavels when the graduate work grade-points were adjusted.

The means of the grade-point averages for the two Eroups vary less than one-tenth of a quality-point at all but one level-that of the junior-senior work where the mean for the transfers was 3.087 and 2.960 for the nontransfors.

When the transfers were divided into two groups, the sinsilarity of coefricients of correlation stopped, indicating that the transfer group was made up of two dissinilar Eroups. A total of 262 , or 17.47 per cent of the transfors, had taken theif first degree from achool where a Phi Beta Kappa chapter had been established but then had transferred to a non-hi-Eetanmppa sohool for the mater's degreo. The other 1,238 grackutes, representing 62.53 per cent of the transfera, had taken the first degree in one non-Phi-BetaRappa achool and then had tranoferred to another such sehool for the graduate schooling. The usual correlations for these two divisions are shown in Table VI.

## table VI

RELATIONSMIPS BETTEEN UMDERGRADUATE AND GRADUATE GRADF-POINT AVERAGES FOR THO DLFFERENT OROUPS OP TRANSESRS
Relationshipa

From Phi-Bota-Kappa Schools to Non-Fhi-Beta-Ksppa Schools Croup


Rucg ${ }^{10}$ would call all the coefficients in the first part of the above table "present but low," whereas those in the latter part of the table were about the saine as other parts of this study have produced--"mariedly present." There definitoly was a significent difference in the two eroups and in each case the erade-point averages of the junior-senicr work were a better criterion than were those for the freshman-sophomore work; in like manner, the total undergraduate work was better index of prediction than was the junior-senior work.

The figures presented in Table VI vere a very strong. ondorsersent of the three schools in Texas which had PhI Beta Kappe chapters. The relationships indicated that in so far as eraduate study was concorned, it made little or no difference what type of undergraduate marks the atudents from these schools made because they correlated so low with eraduate succese when the graduate work was done in schoola not having a Phi Beta Rappa chaptor. In fact, atudents from Phi Beta Kappa undereraduate schools made a higher over-all graduate average when they transferred to the non-Pbi-BetaRappa achools than those who originally came from the lattertype institutions. The same type of statement could be made when the eraduate marks were adjusted, although both eroups naturally showed decrease in averages.

10 Harold 0. Rues, loc. olt.

One could bettor predict the graduate performance from every level of the undergraduate work of those students who avoided the Phi-Eete-Kappe institutions. In other words, If a student made good grades in a school which did not have the honorary society established, he would tend to make good marks in another such school, but even those who made poor marks in Phi-Bota-Kappa schools were successful on the graduate level in other schools. However, if all of the cases studied had not been successful graduate students, the converse might just as well have been true.

The means revealed that freshmon-sophomore maria in member schools were slightly higher than those in nonmember schools, being 2.644 and 2.591 , respectively, while the reverse was true at the other two levels. Those mean averages given in the same order were 3.000 and 3.105 at the junior-senior level and 2.824 and 2.848 for the total undergraduate work.

The non-transfers were studied separately by instituions in order to see whether on could better predict in one school or another the graduate marks from the undergraduate grade-point averages. The relationships derived by schools are given in Table VII.

## TABLE VII

RELATIONSHPPS EFTFEEN UNDFRCRAZNBTE AND GKADUATE CRADEMPOINT AVETAOES FOR NOR-TRAKSFERS IN WIRE DIFFERENT SCHOOLS

| Relationships | 5 | P*E* |
| :---: | :---: | :---: |
| School Number 1 Where $\mathrm{N}=200$ |  |  |
| (55) Gradempoint averazes for freshmansophomore work and graduate work | .513 | . 035 |
| (56) Orado-point averages for juniorsenior work and Eraduate mork | .528 | .034 |
| (57) Grado-point avorages for total undergraduate work and Eraduate work | .546 | .033 |
| (58) Crade-point averages for freahmansophomore work and adjusted graduate work | .469 | .037 |
| (59) Grade-point averages for junior-senior work and adjusted eraduate work | .516 | . 035 |
| (60) Grade-point averaes for totel undereraduate work and adjusted graduate work | .536 | .034 |

School Number 2 where it $=275$
(61) Orade-point averages for freshmansophomore work and ereluate work
$.420 \quad .034$
(62) Orade-point averages ror juniorsenior work and graduate work .588
(63) arade-point averages for total undergraduate work and eraduate work . 524
(64) Grate-point averages for fresbansophomore woriz and adjusted graduate work
.437 .033
(65) Grade-point avereces for junior-senior work and adjusted gracuate work
.528
.029
(66) Crade-point averages for total undergraduate work and adjusted graduate work
.503
.030

TABLE VII (Continued)

| Reletionships | 5 | P* E. |
| :---: | :---: | :---: |
| School \#umber 3 Hhere $=325$ |  |  |
| (67) Grade-point averages for freshnansophomore work and graduate work | .330 | .033 |
| (68) Grade-point averages for juniorsenior work and Eraduate work | .358 | . 032 |
| (69) orade-point averages for total undercraduate work and Eraduat work | .376 | .032 |
| (70) Orade-point averages for freshman sophomore work and adjusted graduate work | .206 | .034 |
| (71) Grado-point avorages for junior-senior work and adjusted eraduato work | . 348 | .033 |
| (72) Crade-point averages for total undergraduate work and adjusted eraduate work | .409 | .032 |
| School Number 4 Where N=125 |  |  |
| (73) Grade-point merages for rreshmansophomore work and errduate work | .421 | .050 |
| (74) Grade-point averages $\mathcal{C}$ or funlorsenior work and graduate work | .416 | . 050 |
| (75) Grado-point averages for total underEraduato work and graduate work | .472 | .047 |
| (76) Grade-point averazes for freshmansophomore woris and adjusted eraduate work | .448 | .048 |
| (77) Grade-point averages for junior-senior work and adjusted Eraduate work | .408 | . 050 |
| (78) Gradompoint averages for total undergraduate work and adjusted eraduate work | .482 | .046 |

## TABLE VII (Continued)

| Relationshtps | 3 | P. E. |
| :---: | :---: | :---: |
| Sohool Number 5 where $4=75$ |  |  |
| (79) Grado-point averagos for freshmensophomore work and Eraduate vork | .624 | .048 |
| (80) Grade-point averages for juniorsenior work and Braduate work | .539 | .055 |
| (81) Grade-point averages for total underEraduate work and graduste work | .665 | .043 |
| (82) Grade-point avorages for freshmansophomore work and adjuated graduate work | .596 | .050 |
| (83) Grado-point averages for junior-sonior work and adjusted graduate work | .497 | .058 |
| (84) Grade-point averages for total underm eraduate work and adjusted graduate work | .604 | .049 |
| School Number 6 Where $\mathrm{N}=125$ |  |  |
| (85) Grade-point averages for freshansophomore work and Eraduate work | .500 | .045 |
| (86) Gradompoint averages for juniorsenior work and graduate work | .530 | .043 |
| (87) Grade-point averages for total under. graduate work and eraduate vork | .580 | .040 |
| (38) Orade-point averages for freehmansophomore work and adjusted eraduate work | .458 | . 048 |
| (89) Grade-point averages for junior-senior work and adjusted graduate work | .489 | .046 |
| (90) Grade-point averagea for total undergraduate work and adjusted graduate work | .532 | .043 |

## TABLE VII (Continued)

| Relationships | \% | P.E* |
| :---: | :---: | :---: |
| School Number 7 Where \# $=125$ |  |  |
| (91) Oradempoint averages for fremhanaophomore work and eracuate work | .508 | .045 |
| (92) Grade-polint averajes for funlorsenior work and graduate work | .435 | .049 |
| (93) 3rade-point averages for total undergraduate work and graduate work | .525 | .044 |
| (94) Grade-point averages for freshmansophomore work and adjusted eraduate work | .502 | .045 |
| (95) Grada-point averages for junior-senior work and adjusted Eraduate work | . 351 | . 053 |
| (96) orade-point averazea for total undereraduate work and adjusted graduate work | .491 | . 046 |
| School Number 8 Where $=125$ |  |  |
| (97) Orado-point averages for freshmansophomore woris and eraduate work | .535 | .043 |
| (98) Grade-point averages for junforsenior work and graduate work | .491 | .046 |
| (99) Crade-point averages for total undereraduate work and graduate work | .537 | .043 |
| (200) Grade-point averages for freshmansophomore work nd adjusted gradurto work | .525 | . 044 |
| (101) Grado-point averages for junior-senior work and adjusted Eraduate work | .502 | .046 |
| (102) Grado-point averages for total undergraduate work and adjusted graduat woris | . 529 | .043 |

## TABLE VII (Continued)

| Relationships | 5 | P. ${ }^{\text {d }}$ |
| :---: | :---: | :---: |
| School Number 9 Whore $=125$ |  |  |
| (103) Orade-point averages for freshmensophomore work and graduate work | .434 | .050 |
| (204) Grade-point averages for juniormonior work and graduate work | .494 | .046 |
| (105) Orade-point everages for total underEraduate work and graduate work | .476 | .047 |
| (106) Grade-point averages for freshmansophomore work and adjusted graduste work | .477 | .047 |
| (107) Grado-point averages for Junior-sonior work and adjusted graduate work | .490 | .046 |
| (108) orade-point averages for total undergraduate work and adjusted graduate work | . 505 | . 045 |

From the above table it may be seen that in all but two schools, numbers two and nine, the grade-point averaces for total undergraduate work were the best indicators of graduate work. In the two exceptions, the junior-senior gradepoint averages wore the best indicators, whereas in no one school did the freshman-sophomore work show up as the best Index.

When the relationshipe for each school were compared With those for the total non-tranefers, only two of the schools deviated from that which one would have nomally
expected. These were schools numbered thres and five, the largest and the smallest, respectively, for the purposes of this investigation. The size of the school, however, was not where the dissimilarity atoppod. School nurber rive had the highest group of coerficients of correlation of the ontire study. Purthermore, the correlation between grade-point averagea for total undergraduate work and graduate work $(.665 \pm .043)$ was the highest single coefficient derived and was what Rugg ${ }^{11}$ would call "high." When the total undergraduate work was correlated with the adjusted Eraduate wor\%, the coofficient wes lowered somewhat, but remained a "high". 604. On the other hand, school number three's eroup of correlations was by far the lowest of the nine schools, and for the most part could be classified "Iow." In other words, one mould have had a good chance of predicting graduate echool auccess fairiy accurately in sohool number five, but there was ilttle chance of making a good prediction in school mumber three. These differences could have been the result of one or more of several factors at school number three (or the reverse of these achool nuaber flve), among which were: (1) low reliability or marks given by the instructors; (2) the awarding of high marks to atudents to please them rather then in accordance Fith merit: (3) poor inatructors at ather the gracuate or

[^7]undergraduate level; (4) offering of ereduate courses independent of prerequisitle"s; (5) existonce of a double atandard of marking: and (6) rallure to recoqnize and correct the mistake of aditing inferior students into the graduate school.
A. look at the scattergrans for school number five revealed that no graduate average or adjugted graduate average of less than 3.10 was rocorded, whereas for school number three, graduate averagea of 2.44 and an adjusted grajuate average as low as 0.54 were found. In like manner, achool number three protuced a Ereshman-sophomore Erade-point average as low as 1. 10 , whereas the lowest auch average for school number five was consldersbly higher.

The coerficionts of correlation progressed from 330 , using the freshan-sophomore work and the exaduate merks, to . 358 for the junior-senior work and graduate averagos, and to .376 for the total undergraduate work and graduate work. These were amall differences, and having the total undergraduate wory as the best predictive level agreed with the reaults obtained for school number five. However, school number five ald not show thin type of progression; instead, the correlation between the erade-polnt averages for juniorsenior woriz and eraduate work was al grificentiy lower than elther of the other two coerficienta. In this respect, these atudents followed the finaings of strang, 12 which

[^8]was not usually done in this investigation. The same thing was true when the total ferale population was atudied (see pages 37-33 of this Chapter), so the sex of the school number five tronsfer population was resolved to see if this was the deternining factor, However, it was found thet forty-two, representing 56.00 per cent, of the seventyfive cases were males, so this was not the cause. The academio majors of these seventy-five persons were also checked to see if any particular field of study would follow this eeneral pattorn, but this attempt to explain the cause also falled. School number three, on the other hand, did have more females in the tranafor group. Eere, the famalea numbered 174, or 53.54 per cent of the 325 , whereas the males numbered 151. Here, also, the academic major of Education clained a majority of the students, with 223, or 68.62 per cent, majoring in this field. In school number five, the Education majora were less than majority although thirty-fours or 45.33 per cent, of the transters did select this major.

The various mens for the nine achools and for the total tranafers ere presented in Table VIII.

## TABLE VIII

mEANS OF UNDERGRADUAT AND GRADJATE GRADE-POINT AVERAGES FOR NON-TRANSFERS IN GIDE DIFRERENT SCGOOLS COAPAEED WITR total non-Tralsjers

| School number | Heans |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Freshrasisophomore work | $\begin{aligned} & \text { Juniore } \\ & \text { senior } \\ & \text { work } \end{aligned}$ | Totel undergraduate worix | Graduate work | Adjusted Eraduate work |
| 1 | 2.680 | 2.636 | 2.683 | 3.483 | 3.371 |
| 2 | 2.610 | 2.975 | 2.794 | 3.509 | 3.383 |
| 3 | 2.644 | 2.992 | 2.818 | 3.600 | 3.407 |
| 4 | 2.573 | 2.934 | 2.747 | 3.391 | 3.280 |
| 5 | 2.672 | 3.206 | 2.861 | 3.636 | 3.590 |
| 6 | 2.592 | 2.949 | 2.781 | 3.466 | 3.334 |
| 7 | 2.481 | 2.873 | 2.725 | 3.480 | 3.369 |
| 8 | 2.782 | 3.121 | 2.931 | 3.607 | 3.523 |
| 9 | 2.734 | 3.093 | 2.925 | 3.496 | 3.395 |
| Total <br> Ron- <br> Trenafera | 2.643 | 2.960 | 2.799 | 3.502 | 3.396 |

School number five once acein tood out, as expected, with the highest average of the junior-senior work, the graduste work, and the adjusted eraduate work. And here a final significant difference showed up. When the mean adjusted eraduate work was subtracted from the mean graduate
work, differences ranging from . 046 to .193 of eradepoint were found. These were seemingly ansil differences, but one was more than 420 per cent larger than the other. The smallest loss belonged to school number five, while the largest deductions went to school number three, indicsting that the average eraduate student at school number three was not on an academic par with those at other achoola being investigated.
D. Grade-Point Averages for Ondergraduate Work and Graduate Work According to General areas of Study

In order to determine whether one could better predict graduate marks in various general areas of tudy, all of the $s t u d e n t a$ were divided into six groups according to their academic majors. The coerficients of correlation and thelr respective probable errors for these groups make up Table IX.

## table IX

RELATIONSIIPS BETWRFN UNDERGRADOATE AND GRADUATE GRADE-POINT averages for six ogmsral areas of study

| Rolationships | r | P. E. |
| :---: | :---: | :---: |
| Vooational Majors where $\mathrm{N}=179$ |  |  |
| (109) Grade-point averages for frestmansophomore work and eraduate vork | . 287 | .046 |
| (110) Grade-point averages for juniorsenior work and eraduate work | . 338 | .045 |
| (111) Grade-point averages for total undergraduate work and graduate work | . 352 | . 044 |
| (112) Grade-point averages for froshmansophomore work and adjusted graduate work | . 355 | .044 |
| (113) Grade-point averazes for junior-senior work and adjusted graduate work | . 370 | . 044 |
| (114) Grade-point averages for total undergraduate work and adjusted graduate work | . 384 | .043 |
| Natural sciences Majors where $8=167$ |  |  |
| (115) Grade-point everages for freshmensophomore wort and Eraduate work | . 518 | . 038 |
| (116) orade-point averages for funiorsenior work and graduate work | .574 | . 035 |
| (117) orade-point averages for total underEreduate work and graduate work | .589 | .034 |
| (118) Grade-point averages for freshman. sophomore work and adjusted graduate work | .519 | . 033 |
| (119) Grade-point averages for junior-senior work and adjusted graduate work | .526 | .033 |
| (120) Grade-point averages for total underEraduate work and adjusted graduate work | .558 | . 036 |

## TABLE IX (Continued)

| Relationships | 5 | P. E. |
| :---: | :---: | :---: |
| Busineas Majors Where if $=145$ |  |  |
| (121) Gradempoint averages for freshmansophomore work and graduat work | .363 | .049 |
| (122) Grsde-point averages for juniorsenior work and graduate work | .408 | .047 |
| (123) Grade-point averagea for total underEraduate work and graduate work | .464 | .044 |
| (124) Grade-point averages for freshmansophomore mork and adjusted graduate work | .325 | . 050 |
| (125) Grade-point averages for junior-senior work and edjusted graduate work | . 393 | .047 |
| (126) Grade-point averages for total undergraduate work and adjusted greduate work | .429 | . 046 |
| Lumanities Majors Where $\mathrm{H}=309$ |  |  |
| (127) Orade-point averages for rreshmen* sophomore work and eraduat work | -392 | .032 |
| (129) Grade-point averages for juniorseniox work and eraduat work | .442 | .031 |
| (129) Grade-point averages for total undergraduate work and Eraduate work | .440 | .031 |
| (230) Gradempoint averages for freshmansophomore work and adjusted graduate work | .362 | .033 |
| (131) Grade-point averaces for junior-senior work and adjusted eraduate work | .390 | .032 |
| (132) Grade-point averages for total under graduate work and edjusted eraduste work | .384 | .033 |


| Relationships | $\mathbf{F}$ | P. E. |
| :---: | :---: | :---: |
| Education, Health \& Physical Education majors Where $\mathrm{N}=1,943$ |  |  |
| (133) Grade-point averages for freshmansophomore work and gracuat work | .430 | . 012 |
| (134) Grade-point averagos for juniorsenior worik and graduate mork | .454 | .012 |
| (135) Grade-point averages for total undergraduate work and graduate work | .405 | .013 |
| (136) Grade-point averages for freshaansophomore work and adjusted gredunte work | .404 | .013 |
| (137) Grade-point averages for junior-aenior work and adjusted graduate work | .430 | . 012 |
| (138) Grade-point averages for total undergraduate work and adjusted graduste work | .384 | .013 |
| Social Science Majors Where $\mathrm{N}=257$ |  |  |
| (139) Oradempolnt averages for freshman- <br> sophonore work and Eraduate work <br> $.415 \quad .035$ |  |  |
| (140) Grade-point averages for juniorsenior work and graduate work .521 . 031 |  |  |
| (141) Grade-point averages for total under graduate work and graduate work .511 . 031 |  |  |
| (142) Grade-point averagea for freshanan-sophonore work and adusted graduate work .383 . 036 |  |  |
| (143) Grade-point averages for junior-senior work and adjusted graduate work$.505 \quad .031$ |  |  |
| (144) Grede-point averages for total under- |  |  |

Although very few general statements could be made about the information presented in the above table, it was seon that in every case the relationship between juniorsenior work and graduate work was higher than that for the freshan-sophomore averages and graduat averages. In onehaif the casea the coefficienta went oven higher when one progreased to the total undergraduate work relationshlp with graduate woric (the vocational, natural acience, and business Eroups), but decreased in the other eroups. For the most part, the relationshipa between the various levels and the adjusted graduate work were corrospondingly lower than bee tween the ame levels and the regular graduate work, but the direct opposite was true for all three pairs of coofficients for the vocational majors, indicating a deviation from the normal expectations with this group. Correlation number 118 was also very silghtiy lower than its correspondent, number 115.

The vocational majors group, which produced the second lowest set of correlations of the study, was composed of thirty-six male majore in Industriel Arts, seventeen females In Home EConomics, and 126 males with majora in Vocational Agriculture or Agriculture Fducation. Thls was a total of 179, which reprosented 5.967 per cent of the total population. It was evident from the correlations that there was little predictive value of undergraduate marke in this fielc-it
apperently made little difference how well a student did on any part of his undergraduate work. Tho ocattergrazas for these correlations showed more spread of tally marks than did any other of the entire study.

Another eroup that showed considerable spread on the scattergran was the busineas majors, and this group was noxt to the worst in producing coefficients from which reliable predictions could be made. As with the vocational majors, the coerficiente were larger as one progesesed from the freshman-sophomore work to the junior-aenior work, end finally to the total undergraduate work. the business majors did not, however, produce larger correlations when the adjusted graduate work was considered. The business majors consisted of 117 malea and twenty-eight femeles ( 4.833 per cent of the total) with majors in Business, Economics, Accounting, Managenent, Marketing; or Business Education. Although the scattererame for the humanitles looked as if they would produce mach better relationshipa between the various sets of date, the coerficienta of correlation for this group were but very ilttie bigher than those for the business group. In the humanities group were included 133 males and 176 females, together making 10.300 per cent of the ceses, with academic majors in English, Spanish, Art, Speech, Religion and Roligious Education, Bible, Fhilosophy, \#usic and Husic Education, Voice, Drama, Radio, Photography, Composition, and Theory.

The Education group, which included those etudents who had majored in the three main branchos of Sducation (elementary, socondary, ond adninistrative), Culdance, Superviaion, Special Education, Recreation, and Health Ehysical Education, wes by far the most mamerous. This group was come prised or 1,230 reasles and 813 males, a total of 1,943 , or 64.77 per cent of the entire atudent body considered. Since the group was so large, it was expected that the correlations would be practically the same as those for the ontire population, and such was the case, even to the deviations for each corresponding coefficient.

The scattergrams for the social soience majors, who represented 8.567 per cent or the total population, indicated that the tally marks are pushed somewhat to the right, thus showing that these gradunte marka were higher than those for other groups. This ahift was even more ovident whon the adjusted graduate marks were tallied. The coerficients of correlation for this group wers the second highest in this part of the investigation. The social soience group Included acaderic majors of History, psychology, Geography, Sociology, Government, Political Science, and Social Studiea. The tally marks for the natural sefence mejors were even farther to the right of the sheet, and this especially showed up for the data concerning the junior-senior years of atudy. The correlations for this group, consisting of 144 malea and twenty-three fomales (or a total of 5.567 per cent of the
easea) who majored in such academio courses as Mathematics, Blology, Chealstry, Fhysice, varlous branches of Engineering, and fielda related to Medicine; were consistentiy the highest of any group in this part of the investigation. These hiek coerficients tended to corroborate the often-expressed idea that it takes the best students to mejor in the sciences, and oertainly one could predict their graduate marks from their undergraduate worls with more reliability than in the other areas of atudy.

Table $X$, which is similar to Table VIII, Elves the meana for the various groups of atudy.

TABLE X
means of dmpergradjate had graduate grade-point averages for six GEMERAL ARTAS OP STUDY COMPARED mITA TOTAL POPULATION

| Area of study | means |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { Freahrian- } \\ & \text { sophomore } \\ & \text { work } \end{aligned}$ | $\begin{aligned} & \text { Juntor- } \\ & \text { senior } \\ & \text { work } \end{aligned}$ | $\begin{gathered} \text { Total undor- } \\ \text { graduate } \\ \text { work } \end{gathered}$ | Graduate work | Adjusted Eraduato work |
| Vocational | 2.397 | 2.833 | 2.602 | 3.382 | 3.223 |
| Natural <br> sciences | 2.784 | 3.087 | 2.945 | 3.571 | 3.473 |
| Business | 2.585 | 2.967 | 2.773 | 3.449 | 3.290 |
| Humanities | 2.942 | 3.233 | 3.090 | 3.629 | 3.568 |
| Fducation, liealth physical oducation | 2.573 | 2.945 | 2.758 | 3.479 | 3.373 |
| Social sciences | 2.753 | 3.091 | 2.906 | 3.554 | 3.471 |
| Total popilation | 2.623 | 2.989 | 2.810 | 3.497 | 3.394 |

The humanities group had the highest average in all five diviaions, whereas the natural sciences were aecond in every instance except one, the junior-senior work. The difference here was very silght but social sciences were in second place.

Fhen the adjusted graduate mork averages were aubtrected from the resular graduate work averages, the average penalty varied from .061 to .159 of a erade-point. The business and the vooational majors both surfered. 159 of a grade-point losa whereas the humanities eroup took the amallest loss. The sizes of these losses compared somewhat inversely with the sizes of the various coefficients or correlation for a group. Only the area of the humanitios suffered amaller loss than that taken by the total population, but those suffered by the vocational and business groups were more than twice that taken by the total population.
E. Grade-foint Averazes for Undergraduate work and Graduate Work According to Itre-Lag Factor

The final phase of the atudy was the aiviaion of the 3,000 population into five groups in accordance with the number of jears elapsed between the two degrees. These groups were further divided according to sex, and then oorrelations were run between the usual six sets of data in each time diviaion for the males, ferales, and then for the total. These coefficients and their respective probable errors comprise Table XI.

## TAELE XI

RELATIONSEIPS BETYEEN UNDERGRADUATE AND GRADUATEE GRADE-POINT AVERAOES ACCORDINO TO TIMEMLAG PACTOR

| Relationships | Males |  | Femalea |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\boldsymbol{r}$ | PE | $\boldsymbol{r}$ | PE | $\mathbf{r}$ | 92 |
| 0-2 Years Lag group where \#\% | 580 |  | 158 |  | 739 |  |
| (345-147) Grade-point averages for freshan-sophomore work and graduato work | . 520 | . 020 | . 355 | . 047 | .477 | . 019 |
| (148-150) arado-point averages for junior-senior work and graduste work | .547 | . 020 | .480 | . 041 | . 550 | . 017 |
| (151-153) Grade-point averages for total undergraduate woriz and graduate work | . 522 | . 020 | . 420 | .044 | . 522 | .017 |
| (154-156) Grade-point aver. ages for freshman-sophomore work and adjusted graduate work | . 457 | . 022 | .314 | . 048 | .435 | . 020 |
| (157-159) Grade-point averages for junior-senior work and adjustod graduate work | . 532 | . 020 | . 430 | . 044 | . 506 | . 018 |
| (160-162) Grade-point avereges for totel underEraduste work and adjusted graduate roric | . 500 | . 021 | . 397 | . 045 | . 504 | . 018 |
| 3-5 Years Lag Group there $\mathrm{N}=$ |  |  |  |  |  | 1 |
| (163-165) Grade-point averazes ror freshan-sophomore work and graduate work | . 457 | . 034 | . 472 | . 033 | .471 | . 023 |
| (166-168) Grado-point avorages for junlor-senior work and graduate work | . 529 | . 031 | . 499 | . 032 | . 531 | . 022 |

## TABLE XI (Continued)

| Relationships | Wales |  | Feiales |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | r | PI | r | PE | r | PE |
| (169-171) Grade-point averages for total undergraduate work and eraduate mork | .524 | . 031 | . 474 | . 033 | .520 | . 022 |
| (272-174) Grade-point everages for freahran-sophomore work and adjusted graduate work | . 454 | . 034 | . 454 | . 034 | . 471 | . 023 |
| (175-177) Grade-point averages for junior-benior woric and adjusted eraduete work | .530 | . 031 | . 494 | . 032 | . 518 | . 022 |
| (178-180) Grado-point everages for total undergraduate work and adjusted graduate work | . 535 | . 030 | . 473 | . 033 | +520 | . 022 |
| 6-10 Years Lag Group where $\mathrm{N}=$ |  | 33 |  | 33 |  | 36 |
| (181-183) Grade-point averages for freshman-sophomore work and graduete work | . 502 | . 030 | . 480 | .028 | .488 | . 020 |
| (184-196) Grade-point averages for junior-senior work and graduate work | .536 | . 029 | . 522 | . 026 | . 524 | . 019 |
| (287-189) Grade-point averag̃os for total undergraduate work and eraduat work | . 512 | . 030 | . 511 | . 027 | . 441 | . 022 |
| (190-192) Grede-point everagea for freshman-sophomore work and adjusted graduate work | . 488 | . 031 | . 456 | . 028 | . 445 | . 021 |

## TABLE XI (Contimaed)

| Relationships | Hales |  | Females |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | r | PE | r | FE | $\boldsymbol{r}$ | PE |
| (193-195) Grado-point averages for junior-senior vork and adjusted graduate work | . 517 | . 029 | . 494 | . 027 | . 479 | . 021 |
| (196-198) Grade-point averagea for total underEraduate work and adjusted graduate work | . 530 | . 029 | . 524 | . 026 | . 516 | . 020 |
| 11-20 Years Lag Group where | $=$ | 68 |  |  |  | 14 |
| (199-201) Grade-point averagea for freshman-sophomore work and graduate work | . 346 | . 031 | .415 | . 021 | . 408 | .019 |
| (202-204) Grade-point averages for junior-senior work and Eraduate work | . 452 | . 028 | . 420 | . 024 | . 435 | . 013 |
| (205-207) Grade-point averages for total under. graduate work and graduste work | . 428 | . 029 | . 416 | . 024 | .407 | . 019 |
| (208-210) Grade-point averages for freshman-sophomore work and adjusted graduate work | . 304 | . 032 | . 377 | . 025 | . 381 | . 019 |
| (211-213) Grade-point averages for junior-senior work and adjusted graduate vork | - 399 | . 030 | .393 | . 024 | . 391 | . 019 |
| (214-216) Grada-point averages for total undereraduate work and adjusted greduate work | . 396 | . 030 | . 372 | . 024 | . 373 | . 019 |

## TABLE XI (Continued)

| Rolationships | Helos |  | Female |  | Totel |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\boldsymbol{r}$ | PE | F | PE | r | PE |
| Over 20 Years Lag Group Yhore | 1 | 62 | 149 |  | 211 |  |
| (217-219) Grade-point averages for freshman-sophomore work and graduate work | . 440 | . 069 | . 389 | . 047 | . 424 | . 038 |
| (220-222) Grade-point aver. ages for junior-senior work and graduate work | . 522 | . 062 | . 443 | . 044 | . 458 | . 037 |
| (223-225) Grade-point averages for total undergraduate work and graduate work | . 526 | . 062 | . 390 | . 047 | . 423 | .033 |
| (226-228) Grade-point aver. ages for Ireshman-sophomore work and adjusted graduate mork | . 451 | . 068 | . 362 | . 048 | .398 | . 039 |
| (229-231) Grade-point averages for junior-senior work and ndjusted Eraduate work | . 502 | . 064 | . 428 | . 045 | .440 | . 037 |
| (232-234) Grade-point averages for total under. graduate work and adjusted eraduate work | . 496 | . 065 | . 393 | . 047 | . 420 | . 038 |

The rirst thre groups had very sinllar trends in their correlations which were approximately the same size for the various sets of data. However, the fourth group, those that had time-1ag factor of 11-20 years and compr1sed 30.467 per cent of the total, showod an appreciable drop in correlation In every instance. The last group, those 211 cases, representing
7.033 per cent, who had waited more than twenty jears to take their second degree, continued the lower trend of correlations. It would therefore seem that the break to lower predictive ability came about the end of the tenth joar.

This fourth group was probably made up of five main types of personnel. Pirst, those teachers who had not taken the initiative to acquire masteris degree until it was made profitable by adaitional ralses in pay for experience through the Minimum Foundation Program Act, more popularly called the Gilmer-Aiken Bill. Under this Act no further increments in pey were mandatory for additional experience after the twelfth year with only a bachelor's degree. Second, a great number of teachers who were teaching in the elementary sohools but holding a high achool cerifificate were forced to acquire specific or additional training for elmentary school work; many of these people not only were now meeting this requirement but were also applying the work toward a graduate degree so as to continue to get pay increases annuelly. Thirdiy, among the females, there was the group that had taken thelr first degree and then had marricd and atayed in the home. With the grest increase in cost of living that accompanied the years this stuay covered, meny of these people felt that they had to go back to work, but took additional academic treining before returning to employment or after working hours while holding the position. Another group, which would
primarily concern the males, wat composed of persons who were veterans whose 0 . I. 8111 of Rights time was about to explre becaune no advantage had been taken of it. This feceral aid was an adied incentive to those people who had wished to do graduste work previousiy but who had felt they could not spare the time nor afford it financially. Finally, the firth group would be those who would not fit into any of these categories but had wiscelleneous reasons for taking a eradurte degree. With such a diversified group with which to deel, it should not be hard to see why the coefficiente of correlation fell congidersbly at this point. However, oven in this group, the females maintained their position of having a higher correlation than the males on the freshraansophomore level, but as previousiy noted, the malea took the lead on the junior-senior level and maintained it on the total undergraduate work level. In all other groups, the correlation for the male segment at the freshaan-sophomore level was efther higher or they wore very close to the same.

The group with the ereatest predictive ability for the men was that which had the least time-lag factor, which Indicated that if a peraon immediately enrolled for graduate courses upon the completion of the baccalaureate degree, ons could predict his graduste success to a greater extent than if he weited some tine to start graduate work. This was not true for the remale population, for whom the highest
correlations were found in the 6-10 years lag group. Strangely enough, the correlations for the males also exceeded those for the femsles here, but the differences wore very slight.

There was no group where the coefficients for the femalea were consistently superior to those for the men; in fact, the roverse was trua for three of the five groupat (1) 0-2 year: lag: (2) the 6-10 yoars lag; and (3) over 20 yeare lag. This was a marked difference, however, oxiy in the first instance where the males outnumbered the females 580 to 258 . These 738 cases in the $0-2$ years lag group comprise 19.333 per cent of the total.

When the totals were considered, the junior-senior work proved in all five eroups to be a better predictive index than either the fresmen-sophomore work or the total undergraduate work. Pecullariy onough, this same atatement could also be made for the fomales, but it was not true for the men. Just as matter of interest, it should be noted that the longest lapse of time betweon degrees was credited to a male who waited thirtj-nine jears efter taking hi: baccalaureate degree before recolving the master'a degree. The female who had the ereatest leg factor waited thirty-zeven years. However, in the group that waited twenty yecre or longer, the females outnumbered the men 14,9 to sixty-two.

The means for the various groups are presented in Table XII.

MEATS OF UNDERGRADOATE AND GRADUATE GRADFMPOIRT AVIRACES FOR TIME-LAG FACTOR GROUPS ACCORDIRG TO SEX COMPARFD WITH TOTALS

| Timo-leg group | Freahnansophorsore work | Juniorsenior worls | Total undergraduate work | Graduate work | Adjusted graduate work |
| :---: | :---: | :---: | :---: | :---: | :---: |

0-2 yeare:

| Males | 2.643 | 3.015 | 2.795 | 3.451 | 3.316 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Females | 2.852 | 3.104 | 3.024 | 3.554 | 3.498 |
| Total group | 2.687 | 3.051 | 2.344 | 3.476 | 3.363 |

3-5 yeara:

| Males | 2.523 | 2.934 | 2.733 | 3.450 | 3.327 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Femalos | 2.753 | 3.121 | 2.928 | 3.529 | 3.439 |
| Totel group | 2.641 | 3.028 | 2.831 | 3.489 | 3.381 |

6-10 yeara:

| Males | 2.525 | 2.901 | 2.711 | 3.520 | 3.416 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Feranies | 2.717 | 3.071 | 2.891 | 3.532 | 3.451 |
| Total group | 2.635 | 3.009 | 2.811 | 3.523 | 3.435 |

11-20 years:

| Hales | 2.532 | 2.994 | 2.705 | 3.493 | 3.132 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Femalea | 2.567 | 2.946 | 2.766 | 3.519 | 3.420 |
| Total group | 2.539 | 2.925 | 2.745 | 3.509 | 3.411 |

over 20 years:

| Males | 2.511 | 2.898 | 2.698 | 3.474 | 3.379 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Fenales | 2.623 | 2.973 | 2.767 | 3.491 | 3.372 |
| Total group | 2.609 | 2.962 | 2.761 | 3.486 | 3.374 |

Total population:

| Males | 2.562 | 2.948 | 2.754 | 3.473 | 3.349 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Femalea | 2.679 | 3.033 | 2.865 | 3.526 | 3.439 |
| Total group | 2.623 | 2.989 | 2.810 | 3.497 | 3.394 |

With one excoption, the females exibited superior averages to the males, and even for that one exception, the adjusted eraduate work for the over 20 years 1 ag group, the two sexea had practically the gan averace. This indicated that through out the study, no matter bow the coefficients of correlation and other data ran, the females maintained higher merka than did the males. This degree of consistency was not expected but was not particularly surprising. Vhen tho adjustiment penaltiea vere applied to eraduate marks, the males suffersa the greater mean logs In every category and this mas acoentuated in the 11-20 jear time-lag group. The fomales also took big adjustrnent loss in this same group, but their Ereatest average loss appeared in the last category, those having over twenty years time lapse betwoen tho two degrees. When the total population wes considered, the edjustment 10sses mounted to . $12 L_{4}$ of grade-point for the males and .087 for the feasalas. The difference between the two appeared amall, but comparatively spaking, the male loss was almost 350 per cent of that for the fexales.

Due to the fillure and lack of persistence of the poorer students, echolestically peaking, the junior-sonior averages are consiatently above those for the freshman-sophomore Jeari. In 1 ike manner, the eraduate averages are superion to those for any part or all of the undergraduate work A possible reason for this has been previously advanced in this study on page 16.

SUMMARY, CONCLOSIONS, AND RECOMMENDATIONS

## 1. Surmary

The purpose of this investigation was to make a atucy of the relationahips existing between undergraduate marise and graduate mariks as possible means of predicting graduate achool success in selected Texrs institutions. When those relationships were established, through computing correlations between the data, the factors affecting them were sought and stuaied to determine what pert in the relationships they played. At least five different factors, which were usually further divided, were brought into conalderation. These included sex differences, veterans of World War II or nonveterans, transfers and non-transfers, the areas of academic etudy, and the time-lag factor between the awarding of the baccalaureate and graduate degrees.

The principal data used were the grade marks earned by 3,000 eraduate studente who had been awarded the master's degree from 1947-48 through 1951-52 by nine graduate achools In the state. Other data, such as sex, academic majorb, dates of degrees, transfer records, atudy under the $G$. I. Bill of Rights, and time-lag between the two dogroes, were avallable from verious bources and were incluced.

An adjustment factor which consisted of an arbitrarily devised systen of penalties wae applied to graduate gradepoint averagea in order to provide a spread of graduate marks at least equal to that possible for uncergraduate work. Another purpose of this adjustment factor was to give a quantitative value to qualitative factora usualiy deemed worthy among graduate students.

The grade-point averages for undergraduate and regular Eraduate, ay well as adjusted graduate, work were correlated at different stagee of the undergraduate study; that is, at the freshman-sophomore level, at the funior-senior level, and at the total undergraduate level. These correlations for the various sets of data were also carried through the abovementioned factors, thereby giving a total of 234 Pearson product-moment coefficiente for the investigation.

## 2. Conclusions

On the bssis of the findings presented in this study, the rollowing conclusions appear validi
(1) There exists a "marked" relationship between undergraduate and graduate marks in all the Texas schools included In this study.
(2) Junior-senior grade-point averages provide a better Index for prediction of ereduate auccess than do the freshmansophomore or the total undergraduate erade-point averages.
(3) There is but a sinall difference in the number of males and females in texas pursuing and achieving gradunte degrees.
(4) Whon the remales are conaldered separately, the freshman-sophomore grade-point average provides by far the best predictive index, giving a "high" coefficient of correla-. tion with graduate merks, whereas the males do not deviate materially from the group as whole.
(5) Non-voteran atudents prove to be better tudents acholastically than do those attending under the ©. I. 8111 of Rights and how a significontly higher decreo of correlation between undergraduata and graduate work.
(6) Thore is no appreciable afference in tho marks atteined by the transfer and non-transfer groups, as defined by this atudy, providing all of the tranaferred work conatitutes a bachelor's degree and comes from my other Texas college.
(7) Studente taking undergraduete work in colleges where a Phi Beta Kappa chapter is established tond to be auccesaful In non-Phi-Beta-Reppa graduate achools irrespective of their undergraduate marks, but this is not true when students take undergraduate work in one non-Phi-Beta-Xappa school and trensfor to another auch achool for graduate work.
(8) Atong the non-transfers where atudent received both degrees from the same institution, the mallest achool studied showed the highest relationships between undergrauate and Eraduate mariks whereas the largest achool included produced the lowest rolationships.
(9) When undorgraduato marks are the criterion for predicting graduate success, little value can be placed on them

In the field of vocational or business aubjeets. Their most reliable use can be utilized in the natural soiences.
(10) Probable succese in graduate work is not contingent upon the time eleaent, so far as the lapse between the two degrees is concerned, until at least ten years have passed.
(11) The atudy of Education and its related subjects is by far the most popular graduate study in the state. Almost two-thirds of the population of this atudy were Education majors, and this trend is even more popular in the independent and church-related colleges than in the somealled teacher's colleges."
(12) Females on the average consiatently maice better marks both on the undereraduate and graduate levela than do melea under the ame conditions.
(13) The requirements of an avorage of " B " and a minimum mark of "C" for accepted credit in the graduate achools appear to have reaulted in a separate standard of marking for eraduate studenta throughout the state.

## 3. Recommendations

In order to make the present study more valuable to everyone concemed, the writer presents the following recomendations and suggestions:
(1) The proper authorities in the various graduate sohools of the atate might do well to examine and evaluate their present pollcies of otudent aduission in the light of the findincs of this investigation.
(2) The personnel in charge of vocational and business departments should be particuleriy critical of the present procedures used in the selection of their graduate students.
(3) The undorgraduate srade-point average achioved by the individual atudent usually shoula not be the wole criterion considered in selecting him for admisaion to graduate study.
(4) A similar atucy should be made in which the population would consist of Fegro graduate students only.
(5) A similer study in the non-coeducational graduate schools would prove of considerable interest and value.
(6) The recipienta of boctor'e degrees awarded in the atate should be studied in a lik manner as were the successm ful master'a candidates here.
(7) Further atudy of the transfer students should be mads, but this time those students who toolr thoir undergraduate work in non-Phi-Beta-Kappa choola and then transforred to a school with such a chapter for their eraduate work should be considered.
(8) The marks of eraduate tudents who write a thesis chould be contrasted with those who do a research problera or merely take surficiont hours of ereat to recelve a master's degree. Thia atudy might alwo investigate the realm of the various mester's degrees.
(9) In each school a further investigation of the marka achieved by atudent veterans as compared with those of nonveterans shoula prove of considerable local value.
(20) A similar atudy made in each of the various atates of the nation would prove interesting and valuable for comparison purposes.
(11) A stucy should be made to ferret out and weight those factors which might be responsible for the suaden Increase in averages of grade-points for graduat atudents over those for undergraduat atudents.

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