A Study of Various Factors Related to Success in College Physics.

Sam Adams
Louisiana State University and Agricultural & Mechanical College

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A STUDY OF VARIOUS FACTORS RELATED TO
SUCCESS IN COLLEGE PHYSICS

A Dissertation

Presented to
the Faculty of the Graduate School
Louisiana State University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
Sam Adams
B. S., Delta State Teachers College, 1936
M. A., Louisiana State University, 1940
MANUSCRIPT THESES

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The writer wishes to express his appreciation to Dr. H. L. Garrett, who has served in the role of major professor and general advisor. He wishes also to express his thanks to the members of his committee, Dr. L. M. Harrison, Dr. W. A. Lawrence, Dr. M. M. Vick and Dr. Max Goodrich; to Dean A. R. Choppin and Dr. Wilson Thiede for making the necessary records available; and to Mr. Alfred Murray for IBM work. The job could not have been finished without the encouragement and advice of his wife, Mrs. Grace Boudreaux Adams.
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ABSTRACT

This study dealt with various aspects of the general problem of articulation. Specifically it was concerned with a number of factors as related to success in college physics.

The first group to be studied (Group A) was composed of 877 students who took Physics 51-52 or Physics 61-62 at Louisiana State University during the regular school sessions of 1947-1948, 1948-1949, and 1949-1950. The backgrounds of this group were studied with respect to the following items: (1) achievement in college physics; (2) achievement in the high school sciences; (3) achievement in high school mathematics; (4) achievement in high school English; (5) percentile rank in class; (6) age; and (7) veteran status. These items were then studied with reference to achievement in college physics. The highest coefficient of correlation with respect to college physics achievement was found for high school physics ($r = .324$); the lowest was found for the high school science average ($r = .204$). The only age group showing notably superior work in college physics fell in the 26-and-above interval. There was no particular difference in college physics achievement between the veteran and nonveteran groups.

Group A was further investigated as to various types of college-level work, including: (1) achievement in college mathematics 1-2; and (2) percentile rank on the Purdue Placement Test in English, the Cooperative Test of General Proficiency in the Field of Mathematics, the American Council on Education Psychological
Examination, the "quantitative" part of this test, the Iowa Silent Reading Test, a placement test in chemistry, and a composite of all of these tests. These items were then studied from the standpoint of achievement in college physics. The highest coefficient of correlation with respect to college physics achievement was for college mathematics 1-2 ($r = .435$). Correlations with test ranks ran considerably lower, ranging from that on the mathematics test ($r = .258$) down to that for the reading test ($r = .077$).

Another phase of this study dealt with the high school records of students who later earned college majors in physics or chemistry. For Group B, which consisted of 164 students earning Bachelor of Science degrees in the College of Chemistry and Physics of Louisiana State University from 1945 through 1950, the following items were explored: (1) high school physics marks; (2) high school chemistry marks; (3) high school mathematics average; and (4) rank in high school graduating class. Group B appeared to consist of students whose high school work had been outstanding in all the phases investigated.

The conclusions of the study were:

(1) Articulation between college physics and various types of high school work was relatively poor.

(2) As the work was taught at the two academic levels, there was little or no difference in college physics achievement between students who had a year of high school physics and those who did not have it.
(3) In general high school marks told more about probable success in college physics than did entrance test ranks.

(4) A relatively high relationship existed between achievement in college physics and achievement in college mathematics 1-2.

(5) There were no notable differences in achievement in college physics between veteran and nonveteran groups.

(6) The only age group showing superior performance in college physics was the group in the 26-and-above age bracket.

(7) College majors in physics and chemistry did outstanding work in high school physics, chemistry and mathematics and ranked high in their graduating classes.
CHAPTER I

INTRODUCTION

This study was concerned with achievement in a specialized college-level field, namely physics. An effort was made to ascertain what items in the backgrounds of the individual physics students exerted an influence on achievement in the physics courses.

In part it dealt with articulation, in that relationships between various items taken from high school records were investigated, particularly with respect to college physics achievement. In part it was concerned with personal histories, in that college physics achievement was studied from the standpoints of student age and veteran status.

A second part of the study had to do with certain types of college-level achievement with emphasis on their relation to success in college physics. Percentile ranks on the various entrance tests, as well as student achievement in the first courses of college mathematics, were considered with respect to college physics achievement.

A third part of this study dealt with a select group, namely those students who earned majors in the fields of chemistry and physics. An effort was made to explore their high school records to ascertain what factors, if any, indicated special aptitude or interest in these fields. In a sense this might be considered as a search for subject articulation.
Numerous studies have been made in the attempt to ascertain what factors contribute toward success in college. Some studies have been pursued dealing with success in particular college courses. In very few cases has work been done regarding success in the course considered here—college physics. Some college teachers have a blanket explanation for all college difficulties: inadequate high school preparation. And certainly one would expect some relationship between high school and college achievement if proper articulation were realized. The purpose of this study was to attempt to find what relationships, if any, existed between success in college physics and certain measurable features of the students' personal and scholastic backgrounds.

As a slightly different approach to the same general problem, the high school records of a group of chemistry and physics majors were investigated. These individuals presumably were somewhat successful in their beginning physics courses, since they saw fit to pursue this or a closely related field in their advanced program.

The specific purposes of this study were: (1) to study relationships between college physics achievement and various items of personal and secondary school backgrounds; (2) to study relationships between success in college physics and various aspects of the college records; and (3) to ascertain what features, if any, were characteristic of the high school records of those students who subsequently gained majors in physics or chemistry.
It is impossible to measure the mental anguish of a sincere college student who finds himself failing to meet the necessary requirements. Yet college records indicate that many students face this situation every year. Doubtless numerous failures are caused by personal factors, such as inability to accept new conditions.

However, it is inescapable that a large number of such situations arise because of improper guidance—or an entire lack of guidance. All too many students start toward a life career about which they know little or nothing. And many of them are equally uninformed as to their own capabilities in their chosen field.

It is impossible to predict the achievement of a single individual in a particular situation, since such things as stamina and motive defy measurement. However, if certain basic relationships could be established between available information and probable success, a groundwork for valid guidance would have been established.

In a recent year, 299 students registered for one of the beginning physics courses at Louisiana State University. Of this group 38 either failed on the first semester's work or withdrew during this term. Since this course is basic in several curricula, this probably means that many of these 38 had to revise their vocational plans during or after their sophomore year.

The importance of this study lies in the fact that, had these 38 known more about the relationships between success in college
physics and achievement along other more familiar lines, they might have been spared a great deal of mental suffering. Also they might have been spared the expense, in time and money, associated with a change in vocational plan at such a late date.

DELIMITATIONS OF THE STUDY

Group A in this study was delimited to those students who completed physics 51-52 or physics 61-62 at Louisiana State University during the regular sessions of 1947-1948, 1948-1949 and 1949-1950. This group was further delimited to those whose high school transcripts were available, either at the Registrar’s office or at the State Department of Education. High school and college marks were used as indicators of achievement, with percentile marks converted to letter marks wherever necessary. High school averages were not used unless the student had two or more years of work in the field under consideration.

Group B included those students who received Bachelor of Science degrees from the College of Chemistry and Physics, Louisiana State University, from 1945 through 1950. This group was further delimited to those whose high school records were available.

SOURCES OF DATA

The basic records for compiling Group A were taken from the files of the Dean of the College of Chemistry and Physics, Louisiana State University. Birth dates, ranks in class, and high school marks
were obtained from the high school transcripts. Veteran status was ascertained through the office of the Director of the Bureau of Veterans Education. Entrance test percentile ranks were taken from the records of the Bureau of Testing and Guidance, Junior Division, Louisiana State University. Mathematics 1-2 marks were compiled from the course grade cards in the Registrar's office.

The Group B list was taken from corrected copies of commencement programs, beginning with the spring of 1945 and ending with the College of Chemistry and Physics graduates in the summer of 1950. Their high school marks and ranks in high school graduating class were obtained from the high school transcripts.

TREATMENT OF DATA

In setting up Group A, class rolls for physics 51 and physics 61 for September, 1947, were transcribed, along with individual marks. These were compared with the second semester rolls for physics 52 and physics 62. The second semester marks of all students who completed these courses were compiled. Similar lists were prepared for groups beginning the physics courses in September, 1948 and September, 1949.

These names, together with college physics marks and the year in which they took beginning physics, were transferred to mimeographed data cards. These individuals were checked against the test record files of the Bureau of Testing and Guidance of the Junior Division. Percentile ranks on the following tests were compiled:

1. The "Quantitative Thinking," part of the American Council
on Education Psychological Examination for College Freshman;

2. The total score on this test;
3. The Iowa Silent Reading Test, Form AM;
4. The Purdue Placement Test in English;
5. The Cooperative Test of General Proficiency in the Field of Mathematics;
6. A locally-prepared chemistry test; and
7. The composite of all these tests.

From the high school transcripts, the following data were taken: birth date, high school from which the student graduated, marks on high school English, mathematics and science courses, and rank in high school class. These cards were then checked against Bureau of Veteran Education records to ascertain veteran status.

Marks were assigned the following numerical values: A = 4, B = 3, C = 2, D = 1, F = 0. The sum of the two semester marks was used as the year mark. Since only three college course series were used (physics 51-52, physics 61-62 and mathematics 1-2), and since each of these courses carries three semester hours of credit, marks instead of point hour ratios were used as measures of achievement. In a comparatively small number of cases, high school marks were given on a percentile scale; these were converted to letter marks for use in this study.

The test data, class marks, percentile rank in class, veteran status and age at the time of registration in college physics were set up in a simple code for use with IBM equipment. This equipment was
used in setting up the frequency distributions and scattergrams for statistical treatment.

Group B was set up by listing, on individual data cards, those students who received Bachelor of Science degrees from the College of Chemistry and Physics from June, 1945, through August, 1950. The following data were compiled from their high school transcripts:

1. High school physics marks;
2. High school chemistry marks;
3. High school mathematics averages; and
4. Percentile ranks in high school graduating class.

**ORDER OF PRESENTATION**

The order of presentation to follow is:

Chapter II, summary of related studies;

Chapter III, college physics achievement related to personal and high school backgrounds;

Chapter IV, college physics achievement related to other aspects of college work;

Chapter V, high school backgrounds of chemistry and physics majors; and

Chapter VI, summary and conclusions.
CHAPTER II

SUMMARY OF RELATED STUDIES

Studies dealing with college achievement are numerous and diverse. A wide variety of methods, situations and conclusions is found. However, it is usually possible to detect certain findings which, to some degree, appear to recur in most of these studies.

Obviously it would be impracticable to summarize all the research which has been done regarding college achievement. Consequently, this literature survey was limited to certain fairly representative studies in this relatively broad field.

These studies have been considered in the following order:

A. Scholastic Factors and College Achievement, including literature summaries dealing with college achievement, studies dealing with general college achievement, studies of college achievement in certain specific fields, and studies of achievement in college physics.

B. Personal Factors and College Achievement, including studies relating achievement and veteran status, and studies relating achievement and age.
Literature summaries dealing with college achievement. Segel\(^1\) made a summary of studies on prediction of success in college. He found that the mean coefficient of correlation between general college scholarship and achievement on the American Council on Education Psychological Examination was .39, with a low of .20. He cited only one study relating this test and achievement in college physics; this investigator found that \( r = .55 \), with physics being given in the freshman year. He found that, in general, \( r \) decreased with each additional semester of college work. But Segel pointed out one recurring problem: "Just what marks from any one high school mean is not known accurately."

A second summary of studies was that by Harris\(^2\) in 1940. He reviewed 328 studies of factors affecting college marks. He found high school average and rank in high school class to be the two best predictive criteria. He cited numerous studies where attempts were made to attribute considerable prognostic value to a single test; however, most of these results were inconclusive. Physics achievement received little attention in these studies; however, it was pointed out that a unit in high school chemistry seemed to give a temporary initial advantage in college chemistry.


Wagner\(^3\) made a literature survey involving 91 studies. She found high school-college science coefficients of correlation ranging from .19 to .43. She concluded that the high school average was a fairly good predictive criterion.

In 1942 Emme\(^4\) reviewed 64 studies dealing with prediction of college success and concluded that rank in class was the best criterion. He emphasized the importance of interest and enjoyment of college work, factors which are usually overlooked.

Attempts to predict scholastic success in engineering schools were studied by Moore\(^5\) in 1949. He found that \(r\)'s relating first semester achievement to various high school criteria usually fell around .35. Studies beyond the first year of college he found to be very scarce.

Another recent survey of literature\(^6\) led to this conclusion:

"The single predictor of general academic success in college is the student's high school performance."

\(^3\) Earle Wagner, "A Survey of the Literature on College Performance Prediction," University of Buffalo Studies, Volume 9, 1934, pp. 194-209.


Studies dealing with general college achievement. A large number of individual studies relating general achievement in high school with that in the first year of college have been reported. A wide diversity of results and conclusions would probably be expected, since local conditions necessarily affect results. A typical case of contrasting conclusions is this: Ashmore found that high school marks were very significant in predicting college success, while Charters found that, "High school marks have proved to be of little significance as predictors of success."

Several other studies produced noteworthy results. Lauer and Evans noted especially that as a student advanced in college, the correlation with high school marks decreased. Clark found that rank in class gave a higher correlation with college average than did high school average; however, in both cases $r$ was below .50.

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Grawford and Burnham\textsuperscript{11} found entrance tests alone to be entirely inadequate as predictive criteria. By way of contrast, Gladfelter\textsuperscript{12} thought that the Cooperative English Test plus the American Council on Education Psychological Test might provide adequate admission criteria without using the high school record at all. Hurd\textsuperscript{13} also emphasized the role of tests. However, he thought that predictions in a given field should be based on tests in that field. Smith\textsuperscript{14} found that coefficients of correlation in certain fields of high school and first semester college work centered around .50; however, many were below this figure. He, as well as many others, found that after the first year of college, the high school record began to lose its predictive value.

In a comparative study of 15 large Michigan high schools, Dressel\textsuperscript{15} found that grades represented wide varieties of achievement.


\textsuperscript{12} W. E. Gladfelter, "The Value of the Cooperative English Test in Predicting Success in College," School and Society, 41:383-84, September 19, 1936.


\textsuperscript{15} Paul L. Dressel, "The Effect of the High School on College Grades," Journal of Educational Psychology, 30:612-17, November, 1939.
even among a fairly homogeneous group of schools. Garrett\textsuperscript{16} found that a combination of English and mathematics constituted the best basis for ranking graduates for the purpose of predicting college success. Byrus\textsuperscript{17} made a unique study in that it was organized for use in counseling. Without using correlations, she showed that quartile patterns in high school were discernible for about two years after college entry.

Of incidental interest were the studies by Ross\textsuperscript{18}, Ferguson\textsuperscript{19} and Sorenson\textsuperscript{20}. These writers took the position that the best predictor of general college success was the student's achievement in high school Latin.

\textsuperscript{17} Ruth Byrus, "Predicting College Success by High School Grades," Nation's Schools, 10:28-30, July, 1932.
\textsuperscript{18} C. F. Ross, "A Method of Forecasting College Success," School and Society, 34:20-22, July 1, 1931.
\textsuperscript{19} George O. Ferguson, Jr., "Some Factors in Predicting College Success," School and Society, 37:566-68, April 29, 1933.
Three studies were worthy of note because of the remarkably high coefficients they obtained. Edds and McCall\textsuperscript{21} found a correlation of .65 between high school and college averages. They used only 85 cases in a small college, and they admitted their college grades ran abnormally high. A coefficient of .64 between high school averages and first semester college marks was found by Schmiz\textsuperscript{22}. He also worked with comparatively few students from a small denominational college, so possibly high college marks may have obtained there. Even higher was the coefficient of correlation of .77 between high school and freshman marks obtained by Finch and Nemzek\textsuperscript{23}. However, they dealt only with University of Minnesota laboratory school graduates who entered that University, so that articulation would be expected to be somewhat easier than is generally the case.

Studies of college achievement in certain specific fields. A great majority of the studies mentioned above have dealt with general achievement at the college level with reference to high school marks or college entrance examinations. However, many other studies have


dealt, in whole or in part, with achievement in particular subject fields or with certain curricula.

One such study was that of Miles\(^2\), who investigated the value of high school and college records in predicting achievement in the arts and sciences curricula. Many of his coefficients of correlation were in the vicinity of .60, which is somewhat surprising in view of the time that elapses between high school and senior college. Perhaps the fact that he dealt with overall achievement rather than with marks in a single course was significant. However, he agreed with many others that rank in high school class is probably as good a predictive criterion as is at present available.

Lawrence\(^2\) investigated achievement in the various senior colleges of Louisiana State University, particularly with respect to entrance examinations. He found that the averages in the last three years of work in the technical colleges gave a coefficient of correlation of .53 with the psychological examination. These averages with respect to the reading test gave a correlation of .41. Like Miles, he dealt with curricula instead of individual courses.


\(^2\) W. A. Lawrence, "An Evaluation of Achievement in the Various Colleges of Louisiana State University with Special Reference to Certain Aspects of the Junior Division," (unpublished Doctor's dissertation, Louisiana State University, Baton Rouge, 1940), p. 130.
Wakeman \(^{26}\) studied the relationship between certain high school subjects and general college chemistry. From this he reached a rather tentative conclusion that a course in high school chemistry helped a college student in beginning chemistry. He found that 94 of the 107 high schools he studied gave students higher chemistry grades than they made in college, a tendency which appeared to be fairly general.

Another study concerning college chemistry was that of Oakley \(^{27}\). Dealing primarily with test scores rather than with letter grades, he concluded that high school chemistry was a significant help in college chemistry. A unique feature of Oakley's study was that different predictive criteria appeared to apply to those groups which had not taken high school chemistry. Hoff \(^{28}\) found a very slight advantage (2.7 per cent higher marks) for college chemistry students who had a unit of high school chemistry.

\(^{26}\) O. Wakeman, "High School Subjects and General College Chemistry," School and Society, 41:739-40, June 1, 1935.


A study mentioned by Stoddard\(^2\) is perhaps unique in that the coefficient of correlation between high school and college chemistry was only \(0.14\).

These studies have had to do with a field which is closely related to physics. A number of studies have been concerned with other related fields, such as mathematics. Hanna\(^3\) found that the coefficient of correlation between the high school mathematics average and the freshman mathematics average was \(0.32\). He found the Cooperative General Mathematics Test to be better than the high school average for predictive purposes. Very few workers agreed with him on this point. Douglas and Michaelson\(^4\) and Garrett\(^5\) found a coefficient just under \(0.50\) between high school mathematics averages and achievement in freshman mathematics.

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\(^2\) George D. Stoddard, "The Use of Quantitative Measurements in Inducting the Student into Institutions of Higher Learning and in Predicting His Academic Success," Eighteenth Yearbook of the National Society of College Teachers of Education, 1930, p. 12.


Broom and Lawson\textsuperscript{33} found a coefficient of correlation of .31 between high school and college physical science marks. Gilkey\textsuperscript{34} made an unusual study relating all high school science marks to all college science marks; he found an $r$ of only .15. He reached the conclusion that, "If some type of achievement test could be devised which would measure persistence, effort, determination, mental attitude, interest and memory in addition to mere ability to learn, we should approach the solution to the problem." A relatively high correlation, $r = .58$, between high school rank and first semester freshmen marks in engineering was found by Johnson\textsuperscript{35}.

Studies of achievement in college physics. A number of studies have dealt directly with the field of physics; however, most of these were made at colleges where physics was given in the freshman year. Correlation between high school work and physics would normally be expected to be greater in these courses than would be true where physics was given in the sophomore year.


\textsuperscript{34} Royal Gilkey, "Relation of Success in Certain Subjects in High School to Success in the Same Subject in College," \textit{School Review}, 37:576-88, October, 1929.

Several investigators have been concerned with the problem of subject articulation between high school and college physics, a question which has long been controversial. Hurd\(^36\) found a slight difference in college physics achievement favoring those who had high school physics. Rudy\(^37\) found a significant difference favoring those with the high school physics course. And Han\(^38\), whose coefficients of correlation centered around .30, concluded that, "The common statement that high school physics has no value for those taking college physics is not confirmed."

In a later study, Hurd\(^39\) dealt with articulation among certain college level courses. He obtained a coefficient of correlation of .57 between physics and introductory engineering courses. For freshman mathematics with respect to engineering, the surprisingly low correlation of .27 was found.


Stuit and Lapp[^1] emphasized the importance of mathematical ability in studying college physics. They found a coefficient of correlation of .65 between physics achievement and scores on the Iowa Mathematical Aptitude Test. They concluded that, "Ability in mathematics appears to be more closely related than any other factor to achievement in college physics."

An unusually high coefficient of correlation, .74, between high school and college physics was obtained by Foster[^2]. His results were sharply questioned by Read[^3], particularly because Foster admittedely used a small group but failed to reveal just how many cases were included.

A University of Minnesota study[^4] was conducted under conditions quite similar to those of the present investigation, in that the physics course was given in the sophomore year and was primarily for engineering students. The physics marks for the final quarter of the course gave the following coefficients of correlation: with high


school rank, $r = .17$; with American Council on Education Psychological Test scores, $r = .24$; with the Cooperative English Test scores, $r = .14$; with freshman mathematics point-hour ratios, $r = .51$. The authors described these correlations as "low but positive."

Obviously such diverse findings as have been cited in these studies could not lead to final conclusions. Several trends could, however, be recognized. In general it seemed that high school marks were among the better predictors of college success. Rank in class also was of some value in prediction, with entrance tests occupying a rather uncertain position. However, it should be pointed out that practically all of these correlations were too low to have very much predictive value as to individual achievement. But, as pointed out by Dwyer, "In lieu of individual predictions we attempt to make group predictions. A small $r$ may be useful in making such group predictions."

A majority of investigators pointed out that there was a slight advantage in college physics and chemistry favoring those students who took the corresponding high-school course. Some called the difference significant, but many said that statistically it was not significant. Perhaps it is meaningful, however, that such differences seemed to recur in a great many studies.

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If one were to compare most of the high school physics texts with most of the texts used in beginning college physics, he would find a great deal of similarity. So it would logically follow that, except for more complete coverage of a majority of topics, college courses have similar content to high school courses. Yet the subject articulation between the two courses is obviously rather poor. One possible explanation is that most high school texts abound with practical applications, while many college texts use a more abstract presentation. Possibly wide differences in teaching methods at the two levels are in part responsible. But whatever the reason, it appears rather strange that, with the same basic core of subject material, such low articulation between the two levels has been found.

PERSONAL FACTORS AND COLLEGE ACHIEVEMENT

In addition to scholastic history and its possible bearing on college success, this study was concerned with the effect of two personal factors, namely veteran status and student age.

A rather pronounced cycle can be traced in the literature regarding veterans. After the "GI Bill" became law, but before demobilization really got under way, many college administrators seemed to accept the fact that academic standards would necessarily be "adapted" to the questionable ability of the veterans. Possibly a feeling of relief because such adjustments did not become necessary led many college officials to issue glowing reports, frequently without substantiating data, regarding veteran superiority. However, a relatively
large number of careful studies were made regarding veterans and their scholastic progress.

**Studies relating college achievement and veteran status.** A somewhat comprehensive study was made by Thompson and Flesher\(^4\). They used approximately 8,000 academic records for the winter term of 1946. They found the mean point-hour ratio of veterans to be about one-eighth of a letter grade better than that of the nonveteran group.

Another study based on 1946 records was that of Atkinson\(^5\). He found the academic achievement of veterans to be "appreciably higher." For science students, the veterans obtained a point-hour ratio of 1.66, compared to a ratio of 1.397 for nonveterans. He attributed this difference to greater maturity and stronger motivation on the part of veterans.

In a somewhat subjective article, Koba\(^6\) managed to convey the impression that veterans were making outstanding students from all points of view. However, he reached the surprising conclusion that, "The veteran's maturity and motivation help make him an average student."


Germesey and Cross\textsuperscript{48} investigated achievement among a large group of University of Iowa freshmen. They decided that, "although this study does not indicate a large, statistically significant difference, its results coupled with others do appear to indicate a small but consistent superiority of the student veteran over his non-veteran counterpart."

Epler\textsuperscript{49}, working with comparatively small groups in 1946, found some evidence of a slight advantage favoring veterans; in the veteran group, he found a further advantage favoring married veterans.

Topping\textsuperscript{50} surveyed the literature covering the early post-war period and reached the very general conclusion that, "The academic progress of the veterans was superior to, or at least equalled, that of comparable nonveteran groups."

Most of these studies were concerned with averages or point-hour ratios. However, Kvaraceus and Baker\textsuperscript{51} studied veteran achievement in a single required course, which contained both undergraduate and


\textsuperscript{50} Morris Topping, "Scholastic Achievement of Veterans and Nonveterans at the University of Colorado Extension Center in Denver," School and Society, 68:390-94, December 1, 1948.

graduate students. They observed no significant difference between veterans and nonveterans at either academic level.

A different type of study was made by Love and Hutchison, who compared the pre-service and post-service records of 219 veterans at Ohio State University. They found the point-hour ratio had increased from 2.15 to 2.81 after service in the armed forces. A similar study was reported as a news item from Cornell University. It was reported that a very gratifying change had occurred in the work of a group of veterans who were having academic difficulties prior to entering the armed forces. This group had improved their average grade from 64.0 per cent to 75.3 per cent.

It is probably worth of note that most of the studies in which veterans appeared to be superior students were based on records established immediately after the close of the war. Many later studies failed to observe any notable differences. Such a study was made by Pierson in 1948. The only superiority shown was by the very young veterans, and there the difference was not pronounced.


Shaffer, in another study conducted in 1948, noted that the University of Indiana found the earlier veterans to be superior students but that the differences disappeared later. He suggested that post-war garrison duty had failed to inspire the later groups, or else, "We are now getting the graduates of the 52-20 clubs."

In view of the large volume of material which has been written about veterans in college, there have been surprisingly few real studies made regarding these students. However, if there is a trend discernible, it is this: the group of veterans who entered or re-entered college immediately after the end of the war probably did work which was slightly superior to that of nonveteran students. But there is little evidence that later veteran groups were noticeably superior to their nonveteran counterparts.

Studies relating college achievement and student age. In considering the scholastic achievement of veteran groups, the matter of student age inevitably comes into consideration. Obviously, while a student was acquiring war service, he was also increasing in maturity. Consequently, to attribute any superiority, however slight, to war service without considering age is of doubtful validity.

Many studies relating age and scholarship have been conducted at the secondary or elementary level. Somewhat fewer studies have

dealt with college-level groups. In most of these, however, a fairly uniform pattern was noted.

Ferguson\textsuperscript{56} found that, "Each increment of age between 16 and 21 carries a corresponding decrease in excellence of work." Harris\textsuperscript{57}, in a summary of several studies, noted that younger students appeared to excel, both as to marks and intelligence tests. The next older groups were less successful, but the still older students compared favorably with the younger ones.

Instead of marks, Held\textsuperscript{58} used psychological test scores as measures of college achievement. He found the highest-scoring age groups were those below 17 and those above 21. Since this study was made in 1942, before the war, there were probably few students entering college at ages very far above 21. However, Pierson\textsuperscript{59} made a study which included veteran groups. He found the highest marks were made by the youngest students; the group above 25 years of age came next. His lowest group was those students who were 22 to 24 years old.

\textsuperscript{56} Ferguson, \textit{op. cit.}, pp. 566-68.

\textsuperscript{57} Harris, \textit{op. cit.}, pp. 125-66.


\textsuperscript{59} Pierson, \textit{op. cit.}, pp. 94-95.
Dwyer found the youngest and oldest age groups doing superior work. In a slightly different type of study, Charters found that, "Students entering college at the ages of 15, 16 and 17 do much better work than do students entering at the average age of 18 1/2."

And Patterson found that outstandingly intelligent freshmen were, on an average basis, half a year younger than the average group and a full year younger than the groups of lower intelligence.

It appeared that, in general, the students who were either above or below the average age of college entry at the time of their enrollment were likely to do superior work. The intermediate age groups apparently achieved at a somewhat lower level.

The studies which have been mentioned here were the ones found to be most pertinent to the present investigation. Any general conclusions based on them would necessarily be tentative. However, a few features appeared to be fairly uniform: (1) Subject articulation between high school and college fields appeared to be poor; (2) Veteran superiority appeared to be very slight or entirely absent; and (3) There was a tendency for the younger and older college students to excel in college work.

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60 Paul S. Dwyer, "Correlation Between Age at Entrance and Success in College," Journal of Educational Psychology, 30: 251-64, April, 1939.

61 Charters, op. cit., p. 194.

CHAPTER III

COLLEGE PHYSICS ACHIEVEMENT RELATED TO PERSONAL
AND HIGH SCHOOL BACKGROUND

BACKGROUND

The first part of this chapter evaluates the achievement of Group A in various high school fields. Rank in graduating class is in a sense a measure of general secondary school achievement; therefore, it is studied here. Also the personal factors of student age at the time he began college physics and veteran status are included. And since the common criterion throughout is success in college physics, this is considered here, although it might logically be discussed in Chapter IV. The latter part of this chapter presents the coefficients of correlation between college physics marks and the various criteria under consideration.

Achievement in college physics. Two beginning courses in physics are offered at Louisiana State University. Physics 51-52 is called "General Physics" and is a requirement for several curricula in Arts and Sciences and Education. Physics 61-62 is called "General Physics for Technical Students" and is required for all curricula in the Colleges of Engineering and Chemistry and Physics. However, inquiries within the Department of Physics indicated that physics 51-52 and physics 61-62 were sufficiently similar to justify combining the two for statistical treatment.
The post-war rush into college, and more specifically, into the technical fields, was reflected in the enrollments for physics 51 and physics 61 for the three years under consideration. Table I shows the downward trend in enrollment since 1947.

**Table I**

ENROLLMENT FOR BEGINNING PHYSICS COURSES FOR THE YEARS
1947, 1948 and 1949

<table>
<thead>
<tr>
<th>Course</th>
<th>1947</th>
<th>1948</th>
<th>1949</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51</td>
<td>171</td>
<td>142</td>
<td>90</td>
<td>403</td>
</tr>
<tr>
<td>Physics 61</td>
<td>509</td>
<td>346</td>
<td>209</td>
<td>1,064</td>
</tr>
<tr>
<td>Total</td>
<td>680</td>
<td>488</td>
<td>299</td>
<td>1,467</td>
</tr>
</tbody>
</table>

This compilation included all students whose names were entered on the course grade sheets. As shown by Table I, the enrollment for beginning physics courses in 1949 was somewhat less than half that in 1947. On a percentage basis, the greater reduction was in the physics 61.

Of the 1,467 students beginning physics 51 or 61 in the fall semesters of these three years (midyear and summer enrollments in these courses were fairly small and were not included here), 988, or 67.6 percent, completed the second semester of the series.
However, high school records were not available for 111 of these students. This group of 111 was composed largely of two types of students: (1) foreign students and (2) graduates of out-of-state high schools who transferred to Louisiana State University from another college. In such cases, neither the State Department of Education nor the Registrar's office had a high school transcript.

Thus there remained 877 students who completed both semesters of a course in first-year physics; that is, each of these students acquired two letter marks. As has been mentioned previously, these marks were assigned numerical values, beginning with $A = 4$ and continuing to $F = 0$. In subsequent treatment, these numerical values were added, giving a total mark ranging from 0 for two $F$'s to 8 for two $A$'s.

Table II shows the distribution of total marks, in terms of number of cases and per cent of the total number of cases. This table shows a mean year mark of $1.79^4$, which would be a C-plus average. A sigma of 1.77 indicated that if one were to assume a normal distribution, about 68 per cent of the individual mean marks would fall in the range $1.79^4 \pm 1.77$. The departure from a normal distribution was probably attributable to several factors: (1) each instructor made out his own marks, (2) a large majority of these students probably had the motivation that results from specific vocational plans, and (3) as mentioned earlier, only 67.4 per cent of the original group of registrants completed both courses, hence this study was concerned with a somewhat selective group.
### TABLE IX

**Distribution of Year Marks in Beginning Physics Courses**

<table>
<thead>
<tr>
<th>Year Mark</th>
<th>Number</th>
<th>Per Cent</th>
<th>Mean</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 - 8</td>
<td>116</td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 - 7</td>
<td>115</td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 - 6</td>
<td>156</td>
<td>17.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 - 5</td>
<td>192</td>
<td>21.9</td>
<td>4.794</td>
<td>1.77</td>
</tr>
<tr>
<td>3.1 - 4</td>
<td>149</td>
<td>17.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 - 3</td>
<td>90</td>
<td>10.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 - 2</td>
<td>45</td>
<td>5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 - 1</td>
<td>14</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A number of studies have been cited in which efforts were made to compare college achievement among groups who lacked specific high school training in a particular field with those who had such training. This group of 877 students adapted itself readily to such a comparison, as shown in Table III. This table indicated that 367, or 42 per cent, of the group of 877 had taken a course in high school physics. One student had two records which disagreed as to whether he had a unit in physics; he was not included.

Insofar as the distribution of college physics marks was concerned, the most notable difference was that a larger per cent of the group having high school physics scored in the top step interval in college physics marks. From the standpoint of mean scores, the group which had high school physics was very slightly superior. However, on the basis of the standard error of the difference of two means¹, the difference between these two groups was not significant. It should be pointed out that this difference was comparable to that found in several other studies. Although most of these differences were listed as being without statistical significance, the fact that similar slight differences have recurred frequently is possibly meaningful.

From Table III it is apparent that subject articulation between high school and college physics was very slight. Two facts make this

## TABLE III

**Achievement in College Physics of Students**

**With and Without High School Physics**

<table>
<thead>
<tr>
<th>Year Mark</th>
<th>With High School Physics</th>
<th>Without High School Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per Cent</td>
</tr>
<tr>
<td>7.1 - 8</td>
<td>57</td>
<td>15.6</td>
</tr>
<tr>
<td>6.1 - 7</td>
<td>48</td>
<td>13.0</td>
</tr>
<tr>
<td>5.1 - 6</td>
<td>61</td>
<td>16.5</td>
</tr>
<tr>
<td>4.1 - 5</td>
<td>79</td>
<td>21.5</td>
</tr>
<tr>
<td>3.1 - 4</td>
<td>57</td>
<td>15.6</td>
</tr>
<tr>
<td>2.1 - 3</td>
<td>40</td>
<td>10.8</td>
</tr>
<tr>
<td>1.1 - 2</td>
<td>21</td>
<td>5.6</td>
</tr>
<tr>
<td>0.1 - 1</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>367</td>
<td></td>
</tr>
</tbody>
</table>
lack of articulation difficult to explain; (1) as previously mentioned, the subject matter of the two courses is similar, and (2) many high school physics classes are "college preparatory" in nature. How well they have performed this function is questionable.

Achievement in high school sciences. In studying the achievement of Group A in their high school science work, semester marks in general science, biology, chemistry, physics and senior science were used. In a majority of cases the high school transcripts showed only the year's average. In such cases this mark was doubled to arrive at the year mark.

Such war-time innovations as war science and pre-flight were not included in the present study. The only use of marks in biology, general science and senior science (in a few cases this course was called physical science) was in arriving at the science average. For comparability with year marks, year averages were used, that is the total of the semester marks was divided by the number of years of science taken. The averages of students having less than two units of science were not used.

Table IV presents certain data regarding the achievement, as reflected by teachers' marks, of Group A in their high school science programs. The "per cent" column refers back to the original 877 students in Group A.
Table IV shows that 607, or 69 per cent, of Group A took two or more years of high school science, 498, or 57 per cent, had a year of high school chemistry, and 367, or 42 per cent, had a year of physics. It will be recalled that a year mark of five represents a C and a B or comparable marks. Hence in all three categories shown here, the mean year mark was about a B minus.

A notable feature was that the mean year mark on physics was appreciably lower than that in chemistry. There was no evidence to indicate that there was any great difference in the difficulty of the two courses. However, there were two factors which might have such an effect. First, chemistry was offered by many smaller high schools, whereas physics courses were more frequently offered by the larger urban schools. And there was a notable tendency for the smaller schools to use a more liberal grading system. Second, the courses in chemistry were taken by both boys and girls, whereas in many schools the physics
course was limited almost entirely to boys. And Harris\textsuperscript{2} cited numerous sources to support his statement that, "The preponderance of evidence is that women students get better grades than do men students."

\textbf{Achievement in high school in mathematics.} There has been a marked tendency in the field of physics toward a more quantitative approach. Consequently, the physics courses, particularly at the college level, have become somewhat mathematical in nature. In fact the emphasis on mathematics is such that certain college mathematics courses are listed as prerequisites for physics 51 and physics 61. Hence one would expect to find some sort of relationship between achievement in physics and mathematics.

In a majority of the high schools in Louisiana the mathematics sequence is: first year algebra, plane geometry, and second year algebra. In the larger high schools, solid geometry and plane trigonometry are frequently offered, although these classes are usually comparatively small. Probably the culminating course in mathematics for a majority of Group A was second year algebra; hence achievement in it was investigated in this study.

In order to get an overall view of the students\textquotesingle work in high school mathematics, the year averages in this field were also investigated. Courses which were used in arriving at such averages were: Algebra I, plane geometry, algebra II, plane trigonometry, solid

\textsuperscript{2} Harris, \textit{op. cit.}, pp. 125-66.
geometry, business arithmetic, general arithmetic and general mathematics. Again, war-time courses, such as "war mathematics" were not included.

Table V presents the achievement of Group A in advanced algebra; also it gives the mean year mark for this group; only those students with two or more units in high school mathematics were used in computing averages.

**TABLE V**

**ACHIEVEMENT OF GROUP A IN HIGH SCHOOL MATHEMATICS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Number</th>
<th>Per Cent</th>
<th>Mean Year Mark</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra II</td>
<td>506</td>
<td>58</td>
<td>5.69</td>
<td>1.81</td>
</tr>
<tr>
<td>High School Mathematics</td>
<td>655</td>
<td>75</td>
<td>5.70</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Table V indicates that 58 per cent of Group A took high school algebra II and 75 per cent had two or more units in high school mathematics. The high school mathematics average and the mean year mark in algebra II were practically the same, indicating a high degree of consistency in high school mathematics work.

Comparison with Table IV indicated that, based on teachers' marks, achievement in high school mathematics was slightly higher than in high school science courses. However, this difference is probably not significant.
Achievement in high school English. It was noted by Garrett\textsuperscript{3} that ranks based on the combined records in high school English and mathematics, particularly for the last two years of high school, were quite meaningful in predicting college success. Consequently, an investigation of success in high school English, as well as its relations to success in college physics, was included in this study.

There appeared to be considerable variation among high schools as to how much work in English they required. In many schools, practically all the graduates had four years of English; others seemed to demand somewhat less. It will be noted in Table VI that only 659, or about 75 per cent of Group A, had two or more units in English. Some students took a course in business English, which was not considered here. In some other cases, certain students seemed to have taken the part of a course dealing with literature without continuing into the other phases. These were also excluded from this study.

The mean year mark in senior English was the lowest found for any of the high school fields included in this study. It is interesting to note that the mean mark in algebra II, which is normally considered to be one of the more difficult high school subjects, was .76 higher than that for senior English. One factor might be that, in high schools which were large enough to offer electives, probably most of the students who took algebra II thought they saw a definite need for it. Another is that some high schools expected all seniors to take the course in English. Both of these factors indicate that the senior English group was fairly heterogeneous in nature, so that achievement in this field was correspondingly lowered.

**Rank in class.** Several workers, particularly those who were seeking predictive criteria, have placed considerable emphasis on the rank of the individual in his graduating class. And certainly one would expect this to serve to some degree as a relative measure of a student's overall high school achievement.
However, several factors could enter into such a system, each tending to reduce the validity of rank in class as a measure of achievement. First, rank in class was based primarily—perhaps entirely—on class marks, and class marks frequently fall far short of true measures of success. It is generally recognized that grading standards vary among schools or even between individual teachers in the same school. Consequently, any other measure based primarily on such marks will have the same limitations. Second, the fact that rank in class was set up in the individual schools with a minimum of supervision could possibly give rise to a certain amount of subjectivity in assigning ranks. For example, if two students had equal scholastic averages, some principals might be inclined to give a slight advantage to the one who had given less disciplinary trouble. And third, it would be difficult to make true comparisons as to rank in class if the sizes of the graduating classes varied widely. In discussing this point, Garrett said, "One may conclude that the size of class is a potent factor in determining the significance of ranks, no matter what the basis for computing ranks."

However, despite its shortcomings, rank in class is widely used in studies of achievement. For use in this study, ranks were reduced to a percentile basis by applying the formula:

\[
PR = 100 - \frac{(100R - 50)}{N}
\]

\[4\] Ibid., p. 97.

\[5\] Henry R. Garrett, op. cit., p. 81.
where PR means percentile rank, R is the rank of the individual (counting number one as the highest rank), and N refers to the number of individuals being grouped.

Rank in class was given for 518 students, or 59 per cent of Group A. There appeared to be a tendency to leave off this item on the transcripts prepared in some of the small high schools. Possibly a deficiency of clerical help might account for its omission.

Table VI shows the frequency distribution for those students whose ranks in class were available. This table indicates that 24.4 per cent of those members of Group A whose ranks in class were known ranked in the top ten per cent of their classes. Only 2.7 per cent ranked in the lowest ten per cent of their classes. This would indicate that Group A was a fairly selective group. One would expect that more of the top high school students would probably enter college; further selection occurred during the freshman year. Consequently, it is not surprising to find the top percentile ranks predominating in a course taken in or after the sophomore year.

To illustrate a weakness of individual predictions based on high school records, a particular case is worthy of note. One student included in this study ranked 457th in a class of 469, yet he made a C and a B in physics 61-62 and later completed, with a better than average record, one of the most difficult courses in the University.

Student age. Various studies have indicated that there is apparently some relation between student age and student achievement.
This has made the study of veteran achievement more complex, in that it is hard to tell how much of their scholastic superiority (if there is any) is attributable to their additional age.

Table VIII shows the distribution of Group A according to age at the time they began physics at 16 or 61. This table indicates that the ages of 716 members or 81.6 per cent of Group A were available. The largest single age group fell in the 18-19 year interval; however, many cases fell in the 20-21 and the 22-23 year groups. Only three of these 716 students were in the 30-31 year interval at the time they began college physics. Two of these were definitely veterans; the records of the third indicated that he probably was. Only 28 students were in the 16-17 year group, and of these one was a veteran. The fact that he was entering a sophomore course at this early age would indicate that his term in the armed services must have been quite short.

Those students in this group whose secondary training was acquired in the Louisiana public schools followed an 11-year program. The average freshman who entered college directly from high school probably entered at an age of about 17.5 years. Normal college-level progress would qualify this hypothetical student for beginning physics at about 18.5 years. It will be noted, however, that the mean age of this group of 716 students was 20.5 years. Several factors probably brought this condition about: first, the presence of a large number of veterans; second, the fact that some nonveteran students stayed out of school for a time before entering college; and third, the fact that some students began their physics course later than the sophomore year.
### TABLE VII
DISTRIBUTION OF PERCENTILE RANK IN CLASS

**GROUP A**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Number</th>
<th>Per Cent</th>
<th>Mean</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>91 - 100</td>
<td>126</td>
<td>21.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81 - 90</td>
<td>104</td>
<td>20.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71 - 80</td>
<td>60</td>
<td>11.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61 - 70</td>
<td>61</td>
<td>11.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51 - 60</td>
<td>44</td>
<td>8.5</td>
<td>66.7</td>
<td>25.5</td>
</tr>
<tr>
<td>41 - 50</td>
<td>41</td>
<td>7.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>26</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 - 30</td>
<td>20</td>
<td>3.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 20</td>
<td>22</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 10</td>
<td>14</td>
<td>2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>518</strong></td>
<td>****</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table VIII

**Age Distribution of Group A**

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Per Cent</th>
<th>Mean</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 31</td>
<td>3</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 - 29</td>
<td>15</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 - 27</td>
<td>23</td>
<td>3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 - 25</td>
<td>49</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 - 23</td>
<td>112</td>
<td>15.7</td>
<td>20.506</td>
<td>2.64</td>
</tr>
<tr>
<td>20 - 21</td>
<td>186</td>
<td>26.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 - 19</td>
<td>304</td>
<td>42.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 - 17</td>
<td>24</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>716</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Veteran status. As has been pointed out earlier, there has been no general agreement as to the presence or absence of academic superiority of veterans. Some studies found the veterans of the immediate post-war period somewhat superior, but even on that point there was some controversy.

For this study three sources of evidence were used in establishing the veteran status of students. In many cases a photostatic copy of the discharge was attached to the high school transcript. In other cases, students had applied for college credit for some of their military training. Finally, the records of the Bureau of Veteran Education were checked. These records, however, may have been incomplete as to veterans who were no longer attending school on the "GI Bill." Consequently, there were 90 students in Group A whose veteran status could not be definitely established.

Those 787 students whose veteran status could be established were divided into three categories. Group 1 consisted of 403 nonveterans; Group 2 consisted of 324 Louisiana veterans; and Group 3 contained 60 out-of-state veterans. The original group thus contained 403 nonveterans and 384 veterans.

The distribution with respect to age within the three categories mentioned above is shown by Table IX. It will be noted in Table IX that the mean age for the nonveteran group was almost exactly three years less than that of the veteran group. The comparatively small standard deviation of the nonveteran group indicated more age uniformity, that is
## Table IX

**Age Distribution According to Veteran Status**

<table>
<thead>
<tr>
<th>Age</th>
<th>Nonveterans</th>
<th>Louisiana Veterans</th>
<th>Out-of-State Veterans</th>
<th>All</th>
<th>Veterans</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 31</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>28 - 29</td>
<td>1</td>
<td>12</td>
<td>2</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>26 - 27</td>
<td>3</td>
<td>15</td>
<td>4</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>24 - 25</td>
<td>3</td>
<td>35</td>
<td>10</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>22 - 23</td>
<td>17</td>
<td>77</td>
<td>16</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>20 - 21</td>
<td>52</td>
<td>105</td>
<td>21</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>18 - 19</td>
<td>278</td>
<td>9</td>
<td>2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>16 - 17</td>
<td>23</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>379</strong></td>
<td><strong>256</strong></td>
<td><strong>55</strong></td>
<td><strong>311</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Mean**

- Nonveterans: 19.386
- Louisiana Veterans: 22.368
- Out-of-State Veterans: 22.464
- All: 22.384

**Sigma**

- Nonveterans: 0.671
- Louisiana Veterans: 1.22
- Out-of-State Veterans: 1.15
- All: 1.20
a greater tendency for ages to center around the mean. There is no significant difference between the mean ages of Louisiana and out-of-state veterans.

Table VIII indicates a mean age for Group A of 20.506 years. However, this figure is based on those 716 cases whose ages were known. Table IX is concerned with those 690 students whose age and veteran status were known. Consequently, all students appearing in Table IX also were used in Table VIII; however, 26 cases which were included in Table VIII do not appear in Table IX.

RELATIONSHIPS WITH SUCCESS IN PHYSICS

A common method for studying relationships between two variables is by means of the coefficient of correlation. Several types of procedures can be employed. However, for the purposes of this study, the Pearson Product-Moment type of correlation was used.

It would probably be in order to describe this measurement of relationship. The coefficient $r$ ranges from $-1$, representing perfect positive correlation, to $-1$, representing perfect negative correlation. It is not a percentage relationship, that is, one cannot say that an $r$ of .50 indicates two times the relationship that is indicated by an $r$ of .25. Nor can it be said that an increase in correlation from $r = .40$ to $r = .60$ is equivalent to an increase from $r = .70$ to $r = .90$. The coefficient $r$ is only an index number.

The way a coefficient of correlation is interpreted depends largely on what one proposes to do with it. A coefficient which would
be comparatively large for showing relationships would, for example, be quite small if one proposed to use it as a means of predicting performance.

A weakness of the coefficient of correlation method is brought out by Guilford\(^6\).

Whenever a relationship between two variables is established beyond reasonable doubt, the fact that the correlation coefficient is small may merely mean that the measurement situation is contaminated by many things uncontrolled or not held constant. For example, the correlation between an ability score and scholarship is \( .50 \), since both are measured in a population whose scholarship is also allowed to be determined by effort, attitudes, marking peculiarities of the instructors, and what not.

High school achievement with respect to success in college physics. Table X shows the coefficients of correlation between achievement in college physics and various aspects of high school work, including rank in class. Also included is the probable error of the coefficient (\( FE_r \)), which serves as one method of ascertaining whether or not a particular \( r \) is significant.

It will be noted in Table X that the values of \( r \) ranged from \( .32 \) downward to \( .20 \). Since these are comparatively low, the question arose as to whether or not they actually expressed relationships. According to Garrett\(^7\), one can be reasonably sure that a relationship

---


\(^7\) Henry E. Garrett, op. cit., p. 281.
TABLE X
CORRELATION BETWEEN COLLEGE PHYSICS MARKS AND VARIOUS PHASES OF THE HIGH SCHOOL RECORDS

<table>
<thead>
<tr>
<th>Item from High School Record</th>
<th>Number</th>
<th>Per Cent of Group A</th>
<th>Z</th>
<th>PEr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>367</td>
<td>42</td>
<td>.324</td>
<td>.032</td>
</tr>
<tr>
<td>Rank in Class</td>
<td>518</td>
<td>59</td>
<td>.306</td>
<td>.027</td>
</tr>
<tr>
<td>Algebra II</td>
<td>506</td>
<td>58</td>
<td>.290</td>
<td>.028</td>
</tr>
<tr>
<td>Mathematics Average</td>
<td>655</td>
<td>75</td>
<td>.279</td>
<td>.041</td>
</tr>
<tr>
<td>Chemistry</td>
<td>498</td>
<td>57</td>
<td>.263</td>
<td>.037</td>
</tr>
<tr>
<td>Senior English</td>
<td>622</td>
<td>71</td>
<td>.247</td>
<td>.037</td>
</tr>
<tr>
<td>English Average</td>
<td>659</td>
<td>75</td>
<td>.241</td>
<td>.025</td>
</tr>
<tr>
<td>Science Average</td>
<td>607</td>
<td>69</td>
<td>.204</td>
<td>.026</td>
</tr>
</tbody>
</table>
exists if the obtained $r$ is as much as four times the probable error. The smallest $r$ given here is about eight times its probable error, hence is almost certain to be significant.

Another test is by use of the Wallace-Snedecor tables. The lowest $r$ given in Table X was calculated on the basis of 607 cases. According to these tables an $r$ of only .083 for a group of this size would be significant at the five per cent level. This means that an $r$ of .083 or larger, either positive or negative, could arise by chance when $r$ is zero only five times in $100^8$. Since this lowest $r$ has a value more than twice the .083 mentioned above, it is probably safe to assume that the smallest $r$ obtained indicates a true relationship.

Several features of Table X are worthy of note. The highest $r$ was between high school and college physics, as one would expect. However, the fact that this $r$ was only .324 indicated a state of affairs which has been mentioned earlier, that is the subject articulation between high school and college physics was notably poor. One college physics teacher, in commenting on this situation, argued that students would be better prepared for college physics if high school teachers would stop teaching the course from a college-preparatory point of view. His apparently anomalous position he explained this way: Present courses put too much emphasis on techniques and problem solving,

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8 Guilford, op. cit., p. 211.

both of which are readily forgotten. If the emphasis were on basic principles, more retention would be in evidence. The same idea, he says, is applicable in high school mathematics. However, high school physics teachers are quick to point out the abstract presentation commonly used in college physics. And some can always illustrate their point by describing some notably poor college level teaching. So it is difficult to attribute this condition to any one factor; however, it is an inescapable fact that articulation is well below what one would expect to find.

In numerous studies of general college-level achievement, rank in class received considerable emphasis. It is not surprising to find that it correlated second highest with college physics achievement. Probably no other criterion used in this study yielded as much information about the overall scholastic ability of a student. And this ability should carry over into any field of academic work, at either the high school or collegiate level.

The fact that the two criteria involving mathematical achievement ranked third and fourth would probably indicate that there is a considerable emphasis on the mathematical aspects of college physics. However, the fact that these coefficients were below .30 would probably tend to verify an earlier comment that many high school mathematics teachers give undue emphasis to techniques instead of principles.

Several investigators have found the element of recency to be quite significant in establishing predictive criteria. For example, the highest correlation with second semester English would probably be
with the first semester of the same course. This item of recency may
account for the fact that $r$ for algebra II is slightly higher than for
the mathematics average. The former is frequently taken by seniors,
whereas the average is based on work throughout the high school period.

It is frequently mentioned that the subject contents of
chemistry and physics have a great deal in common. Hence it was
surprising to find that the $r$ between high school chemistry and college
physics was somewhat lower than that between the two levels of physics.
Two elements may enter into the situation. First, where students took
both courses, they ordinarily had chemistry in the junior year and
physics in the senior year. Hence the element of recency may have had
an effect. But probably of greater significance is the fact that
physics was offered primarily by the larger high schools, whereas
chemistry was offered by large and small schools alike. And there is
a pronounced tendency for marks to run high in smaller schools.

The comparatively low $r$'s for English probably indicated that
there was little opportunity for using what might be termed the "English
skills" in college physics. Since the subject-matter presentation in
physics frequently was mathematical in nature, probably this would be
expected. The chief value of high school English achievement here was
in that it told something about the general scholastic ability of the
student.

At first it appears to be rather strange that the high school
science average correlated so slightly with college physics marks. To
give a plausible explanation one must investigate the wide differences
between physical sciences and biological sciences. Aside from the title "science," they actually have little in common. Physics centers around the various forms of energy, while biological science centers around living matter. Physics is operational in nature, while biology is observational. Consequently, there would likely be very little relation between secondary biological science and college physics. Yet the science average had a large contribution from the biological sciences. Since the course in general science was probably half biological, and since this course frequently combined with the course in biology to give a two-year secondary science program, many students who figured in this computation actually had the equivalent to half a year or less of elementary physical science. And even those who had a four-year program of high school science likely had the equivalent of one and a half years of biological science. When this, together with the element of recency, is considered, an $r$ of .20 is not unreasonable.

It should be mentioned that many of these correlations were markedly reduced because the high school marks tended to be rather high. However, as mentioned earlier, between the time of high school graduation and the time of completion of a year of sophomore college physics, numerous factors have entered into the situation to make the group more and more selective. And it would be expected that students with above-average high school records would probably be more likely to survive.

Age and veteran status as related to success in college physics. Since it is very difficult to differentiate between the effects of
these two background items of students, it appeared advisable to deal with them together. To recapitulate, the mean age of Group A, based on 716 cases, was 20.5 years. The mean age of the veterans was 22.38 years, while that of the nonveterans was 19.39 years. The group was approximately evenly divided as to veterans and nonveterans.

Table XI shows the achievement of the various age groups in college physics. These data indicated that Group A followed fairly closely the general pattern found in other studies. The tendency was for the younger and older students to excel, with the lowest achievement being shown about half-way between. However, there are several features worthy of note here.

First, the mean mark of the 16-17 year group, presumably of outstanding students, was only slightly superior to several other groups and actually fell below two others. One plausible explanation is that the type of mind which might serve to get a student graduated from high school at an early age might not excel when it is confronted with the type of work found in college physics. And another possible factor was that some secondary students attended summer school, thus graduating early but not necessarily because of outstanding intelligence.

The high achievement of the 20-21 year group seemed to be unique, in that it represented a complete departure from the usual age-achievement pattern. It was at first thought that this might be caused by the presence of a group of exceptional veteran students whose college entry had been delayed. However, as shown later, this did not serve as a satisfactory explanation.
**TABLE XI**

ACHIEVEMENT IN COLLEGE PHYSICS ACCORDING TO AGE

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Cases</th>
<th>Mean Year Work, College Physics</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 - up</td>
<td>41</td>
<td>6.31</td>
<td>1.70</td>
</tr>
<tr>
<td>24 - 25</td>
<td>49</td>
<td>4.77</td>
<td>1.74</td>
</tr>
<tr>
<td>22 - 23</td>
<td>112</td>
<td>4.46</td>
<td>1.71</td>
</tr>
<tr>
<td>20 - 21</td>
<td>186</td>
<td>5.03</td>
<td>1.76</td>
</tr>
<tr>
<td>18 - 19</td>
<td>304</td>
<td>4.69</td>
<td>1.70</td>
</tr>
<tr>
<td>16 - 17</td>
<td>24</td>
<td>5.01</td>
<td>1.80</td>
</tr>
<tr>
<td>Total</td>
<td>716</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Of course there was some question as to whether the relatively slight differences of means among the five lower age groups actually were significant. However, there was no question that the group of 26-and-above did outstanding work in physics. This group of UL students had a B plus average, with a mean year mark 1.28 higher than their nearest competitor. Earlier studies found that older students tended to excel and also that older veterans tended to excel. Since this group of UL included only four nonveterans, it was impossible to attribute their outstanding work exclusively to either factor.

As to veteran status, four classifications were used: (1) non-veterans, (2) Louisiana veterans, (3) out-of-state veterans, and (4) all veterans. Table XII indicates their achievement in college physics. This table indicates that if one compared the physics achievement of all veterans with nonveterans in Group A he would find no significant difference. The only group showing even a slight superiority was the 60 out-of-state veterans. This could indicate that these students came to this University for a special type of training which they thought would justify the added inconvenience associated with out-of-state attendance. In this case, added motivation would doubtless be present. But this relatively slight difference may actually mean little or nothing.

It was thought that some additional light might be thrown on age-veteran effects if veteran-nonveteran achievement could be compared within particular age groups. It was found, however, that since the
### Table XII

**Achievement in College Physics According to Veteran Status**

<table>
<thead>
<tr>
<th>Veteran Status</th>
<th>Number</th>
<th>Mean Year Mark, College Physics</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonveteran</td>
<td>403</td>
<td>4.779</td>
<td>1.76</td>
</tr>
<tr>
<td>Louisiana Veteran</td>
<td>324</td>
<td>4.674</td>
<td>1.72</td>
</tr>
<tr>
<td>Out-of-State Veteran</td>
<td>60</td>
<td>4.987</td>
<td>1.87</td>
</tr>
<tr>
<td>All Veterans</td>
<td>384</td>
<td>4.72</td>
<td>1.74</td>
</tr>
</tbody>
</table>
mean veteran age was about three years greater than that of nonveterans, comparisons were possible in only three age groups; fairly comparable numbers were found in only one group. Table XIII shows this further breakdown of age groups.

Only in the 20-21 year group were there enough cases in both categories to justify comparisons. However, in all three age groups, the nonveterans seemed to have a slight advantage. This would further emphasize the fact, brought out in connection with Table XI, that only those students, primarily veterans, who were 26 or above at the time they enrolled in beginning physics appeared to do exceptional work in the course.
<table>
<thead>
<tr>
<th>Age</th>
<th>Veteran Status</th>
<th>Number</th>
<th>Mean Year Mark, College Physics</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 19</td>
<td>Veteran</td>
<td>11</td>
<td>4.19</td>
<td>.88</td>
</tr>
<tr>
<td></td>
<td>Nonveteran</td>
<td>278</td>
<td>4.69</td>
<td>1.74</td>
</tr>
<tr>
<td>20 - 21</td>
<td>Veteran</td>
<td>126</td>
<td>5.0</td>
<td>1.74</td>
</tr>
<tr>
<td></td>
<td>Nonveteran</td>
<td>54</td>
<td>5.03</td>
<td>1.81</td>
</tr>
<tr>
<td>22 - 23</td>
<td>Veteran</td>
<td>93</td>
<td>4.42</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td>Nonveteran</td>
<td>17</td>
<td>4.73</td>
<td>1.78</td>
</tr>
</tbody>
</table>
The total of all registrations for physics 51 and 61 for the fall semesters of 1947, 1948 and 1949 was 1,168. Of this group 988 completed physics 52 or physics 62 during the second semester of the year in which they started their work in physics. Of this latter group, high school records were available for 877. This was the original Group A. The mean year mark in college physics for this group was 4.794, with a standard deviation of 1.77.

In Group A 42 per cent had taken a course in high school physics. Their mean year mark in college physics was 0.1 higher than for the group not having high school physics.

Among the various high school fields investigated, the highest marks were in mathematics; the lowest marks were in senior English. The mean percentile rank in class was 68.7, with a standard deviation of 25.5.

Only three students among the 716 whose ages were available were 30 or above at the time they entered the physics course. And 214 students were in the 16-17 year group. The mean age for the entire group of 716 was 20.5 years, with a standard deviation of 2.64. The mean age of nonveterans was 19.39 years; the mean age of veterans was 22.38.

The coefficients of correlation with respect to success in college physics ranged from high school physics ($r = .324$) down to the
science average ($r = .204$). All these correlations were sufficiently large, when considered with respect to group size or FER, to indicate a real relationship. However, they were too small to have any individual predictive value.

The only age group showing any exceptional achievement was the 26-and-above group, with a mean year mark of 6.31. The lowest group was in the 22-23 year range, with a mean of 4.46. No notable difference of achievement between veteran and nonveteran groups was found. The out-of-state veterans may have been slightly superior to nonveterans and Louisiana veterans.

Chapter III has dealt with achievement in college physics and in various high school fields, as well as rank in class, age and veteran status. These criteria were then explored for relationships with success in college physics. The next chapter will be concerned with success on entrance tests and in college mathematics 1-2, especially as related to college physics.
CHAPTER IV

COLLEGE PHYSICS ACHIEVEMENT RELATED TO OTHER ASPECTS
OF COLLEGE WORK

There are certain types of work which normally come in the first year of college and which could conceivably show some relationship with success in college physics. Two such criteria are (1) success in college mathematics 1-2, and (2) rank on the various tests given at or shortly after the time of freshman registration. As was done in Chapter III, these items were explored as to general background, after which they were investigated for relations with college physics.

BACKGROUND

Some type of college mathematics is required for admission to practically all the senior college curricula at Louisiana State University. Certain specialized courses have, in some cases, been established to meet this requirement. However, the most commonly accepted sequence is mathematics 1-2, that is, college algebra followed by plane trigonometry. Consequently, the college mathematics part of this study is limited to these two courses.

During the period of freshman registration, these students were given the following tests: the Purdue Placement Test in English, the Cooperative General Achievement Test in Mathematics and a locally-prepared placement test in chemistry. After coursework had begun,
the following tests were given: the American Council on Education Psychological Examination and the Iowa Silent Reading Test. Raw scores and percentile ranks on these tests became a permanent part of a student's scholastic record. Percentile ranks were used in this study.

Achievement in college mathematics 1-2. These courses are required for many curricula, although students whose advanced work will probably be non-mathematical in nature frequently take a course in introductory college mathematics. In general, however, students whose advanced work will include college physics are expected to take the mathematics 1-2.

One exception is worthy of note. If a student's high school record and mathematics placement test score indicated adequate mathematical preparation, he was permitted to take college algebra and trigonometry (mathematics 3) the first semester, going into analytic geometry the second semester. In a recent year, 26 per cent of the entering freshmen were eligible for this combination. This probably included many students who subsequently entered physics 61.

As has been mentioned earlier, the element of recency is usually found to be quite significant in predictive criteria. For this reason, only those students were included here who took mathematics 1-2 the year before they took a beginning course in physics.

In the overall picture, there were several limiting criteria applied to this group: (1) these students must have entered physics 51 or 61 in September of 1947, 1948 or 1949 and must have completed
the corresponding second semester course in the same school year;
(2) they must have taken mathematics 1-2 in consecutive semesters, and
(3) these courses must have been taken in the school year prior to the
one in which they took beginning physics.

As a result of these limitations, only 340 students, or about
39 per cent of Group A, were included in this study. Table XIV
indicates the achievement in mathematics 1-2 of these students.

Table XIV indicates that almost 11 per cent of this group made
top marks in mathematics 1-2. An examination of the system used in
converting letter marks to numerical equivalents will show that in
cases such as this, where actual marks rather than averages were being
used, the top group consisted of those students who made a mark of A
on both semesters. A combination of A and B would put the student in
the second highest group.

By way of contrast, only 1.2 per cent of this group fell in the
lowest interval. This group consisted almost exclusively of students
who made a mark of D the first semester and F the second, since,
practically without exceptions, students with a failing mark on the
mathematics 1 would repeat that course rather than continuing into
mathematics 2. These data do not bring out any information about
failures in mathematics 1-2, since the original Group A was compiled
from physics rolls, and mathematics was prerequisite for registration
in college physics.
<table>
<thead>
<tr>
<th>Year Mark</th>
<th>Number</th>
<th>Per Cent</th>
<th>Mean</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 - 8</td>
<td>36</td>
<td>10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 - 7</td>
<td>60</td>
<td>17.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 - 6</td>
<td>74</td>
<td>21.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 - 5</td>
<td>69</td>
<td>20.2</td>
<td>4.98</td>
<td>1.60</td>
</tr>
<tr>
<td>3.1 - 4</td>
<td>62</td>
<td>18.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 - 3</td>
<td>28</td>
<td>8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 - 2</td>
<td>7</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 - 1</td>
<td>4</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>340</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Distribution of marks has been investigated for only one other college level course, namely physics. The mean year mark in physics (Table II) was 4.79, compared to 4.98 for mathematics 1-2. However, comparisons here would be of doubtful value, inasmuch as a fairly large number of students, particularly those who went into physics 61-62, were not required to take mathematics 1-2, hence were not included in Table XIV.

Achievement on entrance tests. Very shortly after the freshmen arrived at Louisiana State University, they were given the Purdue Placement Test in English, the Cooperative Test of General Proficiency in the Field of Mathematics and a chemistry placement test. These scores, together with data from the high school records, were used in determining the proper sections of English, chemistry and mathematics. The section lists were subsequently used by advisors in registration.

After classwork had begun, two additional tests were given to all new or transfer students in the Junior Division. The first was the American Council on Education Psychological Examination, a test designed to measure linguistic and quantitative factors of intelligence. The linguistic score provided a measure of verbal facility and the quantitative score was designed to test ability to understand and reason with quantitative concepts. The second test was the Iowa Silent Reading Test. Scores were obtained for the following: rate of reading, comprehension, use of index and selection of key words.
For the purposes of this study, percentile ranks on these five tests were used. In addition, the percentile ranks on the quantitative thinking part of the psychological test were compiled. Hence, two ranks from the psychological test appear in Table XV, one referring to the rank on the quantitative part and the other referring to the rank on the entire test.

In compiling test ranks, only those students were used whose scholastic programs were relatively regular, that is, students who were entering freshman one year or one year and a summer term prior to beginning physics. This probably accounts for the relatively small test groups, since several types of students were excluded. For example, students whose scholastic careers were interrupted, students who failed to leave the Junior Division within a year and students who delayed taking college physics past the sophomore year were not included.

Table XV indicates the number of students taking each test, the per cent of Group A taking the test, and the mean percentile rank and standard deviation on the test. In order to get an overall picture of the meaning of these test ranks, composite ranks were calculated by combining the five percentile ranks of those students who took all of the tests. These composite ranks also appear in Table XV.
TABLE XV

NUMBER OF PARTICIPANTS AND ACHIEVEMENT ON ENTRANCE TESTS

<table>
<thead>
<tr>
<th>Test</th>
<th>Number</th>
<th>Per Cent of Group A</th>
<th>Mean Percentile Rank</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>351</td>
<td>40</td>
<td>74.3</td>
<td>22.73</td>
</tr>
<tr>
<td>Chemistry</td>
<td>360</td>
<td>41</td>
<td>70.7</td>
<td>25.1</td>
</tr>
<tr>
<td>Psychological, (Total)</td>
<td>422</td>
<td>48</td>
<td>66.9</td>
<td>24.2</td>
</tr>
<tr>
<td>Reading</td>
<td>423</td>
<td>48</td>
<td>63.0</td>
<td>26.8</td>
</tr>
<tr>
<td>Psychological, (Quantitative)</td>
<td>318</td>
<td>36</td>
<td>60.4</td>
<td>21.4</td>
</tr>
<tr>
<td>English</td>
<td>411</td>
<td>47</td>
<td>57.3</td>
<td>28.1</td>
</tr>
<tr>
<td>Composite</td>
<td>320</td>
<td>36</td>
<td>67.0</td>
<td>19.5</td>
</tr>
</tbody>
</table>
Several features of Table XV are worthy of note. It is probably not surprising to find that this group of physics students ranked high in mathematics and chemistry tests. However, it is difficult to understand why they ranked higher on the total psychological test (quantitative plus linguistic) than on the quantitative part alone. Apparently the linguistic part of the test was of value, even when applied to this select group of students.

An apparent discrepancy in Table XV was that only 318 cases were shown for the quantitative part of the psychological test but total scores on this test were available for 423 cases. The reason was entirely clerical, in that numerous total ranks were recorded without any entries as to ranks on the two component parts of the test. This same deficiency in records explains why there were more students having composite ranks on the five tests than there were having ranks on the quantitative part of the psychological test.

The fact that this group ranked high in mathematics but mediocre in English would probably be expected in view of their high school records. As was brought out in Chapter III, the mean mark for Group A in senior high school English was 4.93, compared to a mean mark of 5.69 in algebra II.

RELATIONSHIPS WITH SUCCESS IN COLLEGE PHYSICS

In Chapter III the meaning of correlation as a means of measuring relationship between two variables was discussed. The same method was used in studying relationships between achievement in college physics
and various types of work done after college entry. In this connection it should be pointed out that entrance tests were not used as a means of determining whether or not a student should be admitted; rather, most of them were used as a means of homogeneous grouping in specific subject matter fields.

Table XVI shows the number of students in the various categories, the per cent of Group A this number of students represented, and the coefficient of correlation, with its probable error, which was found between college physics achievement and the various college-level criteria.

It will be noted that by far the highest coefficient in Table XVI, indeed the highest found in this entire study, was that between college physics and college mathematics 1-2. There are at least two factors to which this could be attributed: (1) college physics courses necessarily involved considerable mathematics, and (2) these mathematics marks were compiled for the group of students who had taken this course just prior to taking college physics, so that the element of recency doubtless entered into the situation.

The coefficients of correlation for the various entrance tests were all fairly low; however, all except that relating the reading test to college physics could theoretically indicate a true relationship. The only readily available explanation for the low reading test coefficient was that the type of reading required in physics courses was somewhat different from that required in many other types of work. The reading test was presumably based upon non-scientific reading materials.
TABLE XVI

CORRELATIONS BETWEEN COLLEGE PHYSICS MARKS AND VARIOUS PHASES OF THE COLLEGE RECORDS

<table>
<thead>
<tr>
<th>Item From College Record</th>
<th>Number</th>
<th>Per Cent of Group A</th>
<th>r</th>
<th>Fkr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 1-2</td>
<td>340</td>
<td>39</td>
<td>.435</td>
<td>.035</td>
</tr>
<tr>
<td>Mathematics Test</td>
<td>351</td>
<td>40</td>
<td>.258</td>
<td>.050</td>
</tr>
<tr>
<td>Composite Entrance Test</td>
<td>320</td>
<td>36</td>
<td>.214</td>
<td>.036</td>
</tr>
<tr>
<td>Chemistry Test</td>
<td>360</td>
<td>41</td>
<td>.187</td>
<td>.034</td>
</tr>
<tr>
<td>English Test</td>
<td>411</td>
<td>47</td>
<td>.154</td>
<td>.032</td>
</tr>
<tr>
<td>Total Psychological Test</td>
<td>422</td>
<td>48</td>
<td>.130</td>
<td>.032</td>
</tr>
<tr>
<td>Quantitative Psychological Test</td>
<td>418</td>
<td>48</td>
<td>.121</td>
<td>.030</td>
</tr>
<tr>
<td>Reading Test</td>
<td>423</td>
<td>48</td>
<td>.077</td>
<td>.032</td>
</tr>
</tbody>
</table>
Another item in Table XVI which is worthy of note is the relatively low correlation between college physics marks and percentile ranks on the entrance test in chemistry. This is especially strange because the fields of chemistry and physics are usually thought of as being closely related. However, as has been mentioned earlier, this chemistry test was locally prepared. Consequently, it could well have emphasized certain aspects of the field which were of particular interest to the local department of chemistry. Probably a carefully standardized achievement test in chemistry would give a higher correlation with college physics.

During recent years, there appears to have been a trend toward wider use of tests and less use of the high school record in evaluating the probable college success of students. In part this might be attributed to greater facility in compiling and using test data. It appears doubtful, however, if test records based on the work of a few hours, could tell as much about a student as would a high school record based on four years' work. These data appear to bear out this point, since six criteria—college mathematics I-2, high school physics, percentile rank in class, algebra II, high school mathematics average and high school chemistry—all have higher coefficients of correlation with achievement in college physics than does the highest of the entrance tests.
SUMMARY

Of the original Group A, 310 students, or 39 per cent of this group, completed mathematics 1-2 the year before they entered the course in college physics. The mean mark on mathematics 1-2 was 4.98, or just short of a B minus. In view of the difficulty many students encounter in these courses, this mark probably indicated fairly high mathematical ability.

Seven criteria were used from the Junior Division entrance test records. Percentile ranks on the five tests were used. Ranks on the quantitative part of the psychological test were used separately, as was the composite rank based on all five tests. The highest mean percentile rank was 74.3, which was the mean on the mathematics test. The lowest was on the English test, where the mean percentile rank was 57.3.

The highest coefficient of correlation found between college physics achievement and various aspects of the college record was that for mathematics 1-2. This value was .435. The lowest coefficient was that between college physics and the reading test, the coefficient being .077. Since the probable error here was .032, the value of \( r \) fell well below \( k \text{PEF} \), hence there was probably no relationship present.

When one considers that no test was taken within the prescribed time limitations by more than half of Group A, and when it is further considered that these data were a year old at the time the students
entered the physics courses, it becomes apparent that no general conclusions regarding the value, or lack of value, of test data as related to college physics would be justified. However, the evidence indicated that correlations were higher between college physics achievement and several high school criteria than was the case for any of the entrance tests. And physics correlation with college mathematics 1–2 was higher than was found for any of the other criteria used in this study.
CHAPTER V

HIGH SCHOOL BACKGROUND OF CHEMISTRY AND PHYSICS MAJORS

Group A as used in this study consisted of 877 students in physics 51-52 and 61-62. Their achievement in these courses has been explored with respect to numerous criteria, including their high school records. Throughout, the common point of reference has been achievement in college physics.

Group B, however, figured in a different approach to the general problem of achievement in physics. This group consisted of students whose interests and abilities were such that they earned undergraduate majors in chemistry or physics. Most of the curricula in the College of Chemistry and Physics require some advanced work in physics, and all of these curricula require advanced work along related lines. Hence it was probably safe to assume that all the members of Group B did satisfactory work in beginning physics.

As related to the general problem of physics achievement, the two groups represented two viewpoints. Group A consisted of people whose college program included beginning physics. Group B consisted of people whose achievement in this and other freshman or sophomore courses led them to believe they could satisfactorily complete an undergraduate program in physics or chemistry.

From June, 1945, through August, 1950, a total of 216 students earned Bachelor of Science degrees from the College of Chemistry and
Physio* of Louisiana State University. Group B consisted of the 161
members of this group whose high school records were available, either
at the Registrar's office or the State Department of Education.

The high school records of Group B were investigated with
respect to: (1) physics marks, (2) chemistry marks, (3) mathematics
average and (4) rank in class. The achievement of this group with
respect to these criteria is shown in Table XVII.

The fractional part of Group B who had a course in high school
physics was practically the same as for Group A. However, 70 per cent
of the group of majors had high school chemistry, as compared to 57
per cent of Group A. Again there was a marked tendency for high
school chemistry marks to run higher than physics marks.

Some interesting comparisons can be made between the high school
records of Group A, of whom nothing is known beyond their sophomore
year, and those of Group B, who succeeded in completing a baccalaureate
program in chemistry or physics. Table XVII shows these comparisons.
<table>
<thead>
<tr>
<th>Item From High School Record</th>
<th>Number</th>
<th>Per Cent of Group B</th>
<th>Mean</th>
<th>Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics Marks</td>
<td>73</td>
<td>44</td>
<td>5.81</td>
<td>1.72</td>
</tr>
<tr>
<td>Chemistry Marks</td>
<td>115</td>
<td>70</td>
<td>6.592</td>
<td>1.65</td>
</tr>
<tr>
<td>Mathematics Average</td>
<td>162</td>
<td>99</td>
<td>6.346</td>
<td>1.33</td>
</tr>
<tr>
<td>Rank in Class</td>
<td>137</td>
<td>83</td>
<td>82.65</td>
<td>17.3</td>
</tr>
</tbody>
</table>
Table XVIII indicates that the high school record of Group B was superior to that of Group A in all the fields shown. A notable feature was the fact that in chemistry Group B had a mean year mark 1.02 greater than that for Group A. Actually those 115 students in Group B who took the course in high school chemistry maintained the remarkable average of B plus. The fact that a large percentage of Group B majored in college chemistry might indicate that there was better articulation between high school and college chemistry than has been found between the two levels of physics.

Also a comparison of ranks in class showed pronounced superiority of Group B over Group A. In fact if one should try to imagine a hypothetical average member of Group B, he would visualize a high school student with outstanding records in chemistry and mathematics, with a better than average record in physics and with a high rank in his graduating class.
Conclusions. There is every reason to believe that those people who ultimately majored in college chemistry and physics were above average students in high school. In addition to doing exceptional work in several subject fields, they took more courses in mathematics and chemistry, and they ranked high in their graduating classes.

It would be interesting to conduct a similar investigation of high school records of people who earned majors in college fields other than chemistry and physics. Possibly superior high school records would be found for majors in other fields. On the data presented here, it is impossible to attribute such superiority to this group alone; however, there is no question but that Group B had outstanding high school records in the four lines of work investigated here.
This study was concerned with achievement in college physics. It was primarily a study of articulation between college physics and various factors in the personal, high school and college backgrounds of students. A somewhat different approach to the overall question of achievement involved a study of the high school records of students who earned undergraduate majors in physics or chemistry.

During the three years under investigation, a total of 1,167 students entered a beginning course in college physics. Of these, 985, or about 67 per cent of the original group, completed both semesters of their course sequence. However, no high school records were available for 111 of this group, so that Group A actually consisted of 877 students. The mean year mark of Group A for their two semesters of introductory college physics was 4.79, with a standard deviation of 1.77. The mean year mark for the 367 students in Group A who had high school physics was slightly higher than for the 509 who did not take the high school course.

High school records. In Group A, 42 per cent had a course in high school physics, 57 per cent had high school chemistry, and 69 per cent earned two or more secondary school units in science. The mean year mark in chemistry was slightly above the science average and considerably above the mean physics mark.
As to high school mathematics, 58 per cent of Group A had a course in algebra II, and 75 per cent took two or more years in high school mathematics. The means on both of these criteria were at about the B minus level.

A total of 622, or 71 per cent of Group A, had a course in senior English; 75 per cent had two or more years of English. Achievement in senior English was somewhat lower than was the case in several other fields. The mean year mark was 4.93; the high school English average was 5.16.

Rank in the high school class was available for 518 students. The mean rank on a percentile basis, was 68.7, with a standard deviation of 25.5. This would indicate that Group A was probably somewhat above average in their high school work.

Age and veteran status. Age data were available for 716 members of Group A, the mean age being 20.5 years. The veteran status information was available for 787 students, of whom 103 were nonveterans, 321 were Louisiana veterans and 60 were out-of-state veterans. The mean age of the nonveteran group was 19.39 years; that of the veterans was 22.38 years.

The only age group showing notably superior work in college physics was the 26 or above group. Their mean year mark was 6.31 compared to a mean of 4.46 for the lowest group, which was in the 22-23 year age bracket. Regarding veteran status, there was no significant difference between veteran and nonveteran groups as to physics.
achievement. A slight superiority for out-of-state veterans was found, but Louisiana veterans received a mean year mark slightly below that for the nonveterans. No notable veteran-nonveteran differences were found within particular age groups.

College records. The achievement of Group A was investigated for several types of work performed after admission to college. The first of these was achievement in college mathematics 1-2. Also studied were the percentile ranks on psychological, English, reading, mathematics and chemistry placement tests. The "quantitative" part of the psychological test was treated separately, and a composite rank based on the five tests was treated as a criterion.

A total of 340 students, or 39 per cent of Group A, took mathematics 1-2 the year before they entered beginning physics. Their mean year mark was 4.98, with a standard deviation of 1.60.

Mean percentile ranks on placement tests ranged from 74.3 for mathematics, down to 57.3 for English. In order of decreasing mean ranks, the other tests followed this order: chemistry, psychological, reading, and the quantitative part of the psychological. The mean rank on the composite of all five tests was 67.0. Only 36 per cent of Group A had taken all of these tests within a "normal" period prior to registering for physics.

Relationships with college physics. Studies involving age grouping or veteran status as related to achievement are not readily adaptable to correlation methods. Findings involving these items have
been summarised in Chapter VI. However, high school and college marks, rank in class and percentile ranks on tests can be correlated with achievement in physics. These coefficients were as follows:

1. College mathematics 1-2 \( .435 \)
2. High school physics marks \( .324 \)
3. Percentile rank in class \( .306 \)
4. Algebra II marks \( .290 \)
5. High school mathematics average \( .279 \)
6. High school chemistry marks \( .263 \)
7. Mathematics entrance test rank \( .258 \)
8. Senior English marks \( .247 \)
9. High school English average \( .241 \)
10. Composite rank on entrance tests \( .214 \)
11. High school science average \( .204 \)
12. Chemistry entrance test rank \( .187 \)
13. English entrance test rank \( .154 \)
14. Psychological test rank (total) \( .130 \)
15. Psychological test rank (quantitative) \( .121 \)
16. Reading entrance test rank \( .077 \)

On the reading test, \( r = .077 \) and \( F = .032 \). It is doubtful if this indicates a true relationship.

High school records of physics and chemistry majors. From 1945 through 1950, 216 people graduated from Louisiana State University with
majors in physics or chemistry. The high school records were available for 161 of these; these 161 comprised Group B.

High school achievement of Group B in physics, chemistry, mathematics and rank in class was investigated. In Group B 70 per cent took high school physics, their mean year mark being 5.31, with a standard deviation of 1.72. The 70 per cent of Group B who had high school chemistry achieved a mean mark of 6.59, with a standard deviation of 1.65; 99 per cent of Group B had two or more years of mathematics, with an average of 6.35. The mean rank in class for this group was 82.65. In every case the achievement of Group B was definitely superior to that of Group A. Most noticeable superiority of Group B was in chemistry marks and rank in class.

**Conclusions.** On the basis of the findings of this study, the following conclusions appeared to be justified:

1. Articulation between college physics and various types of high school work was relatively poor.

2. As the work was taught at the two academic levels, there was little or no difference in college physics achievement between students who had a year of high school physics and those who didn't have it.

3. In general high school marks told more about probable success in college physics than did entrance test ranks.

5. There were no notable differences in achievement in college physics between veteran and nonveteran groups.

6. The only age group showing superior performance in college physics was the group in the 26-and-above age bracket.

7. College majors in physics and chemistry did outstanding work in high school chemistry, physics and mathematics and ranked high in their graduating classes.

Some final observations. This study, along with many similar ones, has raised considerable doubt as to the validity of high school records alone as a basis for college admission. Even in closely related courses, such as the two levels of physics, information as to achievement in the high school course was of relatively low value in predicting college achievement. This situation may ultimately give rise to some new system of admission. One possibility would be the widespread adoption of methods related to those recommended by the Illinois Secondary School Curriculum Program, in which the high school record is used only incidentally in admissions.

Regarding the matter of articulation, there is ample evidence indicating that much improvement is needed. Apparently high schools are gradually accepting the fact that their chief function is no longer that of college preparation. However, it is doubtful if many college teachers have recognized the changing role of secondary training. Until such time as workers at these two levels can be brought to a realization that theirs is a problem requiring cooperative effort,
rather than mutual criticism, articulation will probably continue to be inadequate.

A great deal has been written about the education of veterans. Certainly a large majority of the veterans have accepted the fact that, in time of national peril, individual aspirations must be changed or postponed. But the blithe assumption by many writers that war service somehow converted poor students to good students seems entirely fallacious. This study, along with numerous others, has indicated that, in general, years spent in service were, from the standpoint of academic scholarship, lost years.
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C. PUBLICATIONS OF LEARNED ORGANIZATIONS


D. UNPUBLISHED MATERIALS


E. NEW ITEMS

BIography

Sam Adams, the youngest child of Samuel F. and Addie E. Adams, was born at Walthall, Mississippi, on March 14, 1916. After graduation from Webster County Agricultural High School in 1932, he entered Wood Junior College for two years of college work. He received a Bachelor of Science degree at Delta State Teachers College in 1936. He began his graduate study at Louisiana State University in 1938 and received a Master of Arts degree in 1940. He re-entered this institution in September, 1949, and completed the requirements for the Doctor of Philosophy degree in January, 1951.

His teaching career began in 1936, when he went to the Porter-ville, Mississippi, high school as science teacher, a position he held for two years. After two years of graduate study, he became physics teacher at Ramsay Technical High School, Birmingham, Alabama. Other positions followed in this order: Area Supervisor of Extension, University of Alabama; civilian instructor in radio, Army Air Forces, with assignments at Scott Field, Illinois, and Sioux Falls, South Dakota; Chief Radioman, United States Maritime Service; work in electronic physics and later in emission spectroscopy at Oak Ridge, Tennessee. He served for two years as an enlisted man in the Army Signal Corps. This included stateside and foreign assignments in a research unit working on radio propagation.

He was married to Grace Boudreaux, of Scott, Louisiana, in 1944. Their daughter, Carolyn, was born on December 25, 1948.
EXAMINATION AND THESIS REPORT

Candidate: Sam Adams
Major Field: Education
Title of Thesis: A Study of Various Factors Related to Success in College Physics

Approved:

[Signatures]

Major Professor and Chairman
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: April 13, 1951