

MASTER'S REPORT

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EFFECTIVENESS OF  
SECONDARY SCHOOL INDUSTRIAL  
ARTS DRAWING IN TEXAS

Submitted by  
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for the Degree of Master of Education  
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WE HEREBY RECOMMEND THAT THE REPORT PREPARED UNDER OUR  
SUPERVISION BY BYRON C. DOGGETT  
ENTITLED EFFECTIVENESS OF SECONDARY SCHOOL INDUSTRIAL  
ARTS DRAWING IN TEXAS

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER OF EDUCATION  
MAJORING IN INDUSTRIAL ARTS EDUCATION

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Permission to publish this report or any part of it  
must be obtained from the Dean of the Graduate School.

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Chapter I  
INTRODUCTION

It is generally recognized that industrial arts drawing is now taught in most of the larger secondary schools throughout the United States. A large percentage of the students who enroll, however, in major courses of study requiring work in drawing on the college level have not studied any phase of this subject in the secondary schools. In regard to those students who have had some secondary school preparation in this field the problem of articulation arises. Cole (4) in 1940 stated:

At the beginning of his college career a freshman's progress is affected by the extent to which his work articulates with what he has taken in high school and the degree to which he has in readiness the particular skills and understandings that his teachers will assume him to have.  
(4:234)

The ability of entering students at the Agricultural and Mechanical College of Texas varies widely and numerous secondary schools are represented which also vary widely in respect to size and location. Of the major courses of study in which these students may enroll, thirteen require the successful completion of three courses

offered by the Department of Engineering Drawing. This study is an attempt to determine whether the grades in these three engineering drawing courses made by students who have had no previous drawing experience differ appreciably from the grades made by students who have had courses in industrial arts drawing while in secondary school.

### The problem

The problem, then, is: On the basis of semester drawing grades in college, what is the value of industrial arts drawing in the secondary schools of Texas to students of engineering drawing at the Agricultural and Mechanical College of Texas?

- Problem analysis.--1. What drawing courses have the students completed in secondary schools?
2. What were the semester grades in college engineering drawing courses completed by the students?
3. What is the central tendency in each engineering drawing course of students who have had no industrial arts drawing in secondary schools?
4. What is the central tendency in each engineering drawing course of students who have had as many as two semesters of industrial arts drawing in secondary schools?
5. What is the central tendency in each engi-



neering drawing course of students who have had three or more semesters of industrial arts drawing in secondary schools?

Delimitation.--This study has been limited to approximately 450 regular first year students at the Agricultural and Mechanical College of Texas who were still enrolled in major courses of study requiring engineering drawing at the conclusion of the 1948-49 session. The following groupings have been omitted from this study:

1. Students having credit in secondary school drawing from states other than Texas.
2. Secondary school drawing courses completed more than five years previous to the 1948-49 session.
3. Students who have had commercial drafting experience.
4. College drawing grades of courses from which the student withdrew before completion.

Chapter II  
REVIEW OF LITERATURE

The literature contained few studies directly concerned with the relationship between secondary school and college drawing courses. Many studies, however, have been made investigating the relation and contribution of other subject matter areas taken in secondary school to closely allied fields in college. A large portion of these investigations have been made in the fields of chemistry and physics which, since laboratory work is usually included, should prove valuable to the present study.

Secondary school chemistry  
and elementary college chemistry

Koos (12), in a study reported in 1925, investigated textbooks and laboratory manuals used in 26 high schools and in 41 institutions of higher learning. He found from the comparisons made that, although there are some differences between high school and first year college courses in chemistry, the courses are in reality much alike.

Hunt (9), in a study at the George Washington University in 1926, found repetition approaching 50 per

cent in elementary college chemistry for those students who had studied the subject in high school. A comparison of grades, made by students who had taken the subject in high school with the grades of those who had not, showed a slight advantage for the first group, Table 1 (9:203).

Table 1.--DISTRIBUTION OF SEMESTER GRADES IN FIRST-YEAR COLLEGE CHEMISTRY AT THE GEORGE WASHINGTON UNIVERSITY.

Grade	With one-year high school course		With no preliminary course	
	Number	Per Cent	Number	Per cent
A	1	0.9	--	--
B	35	32.4	14	23.0
C	64	59.3	35	57.4
D	8	7.4	11	18.0
E & F	--	--	1	1.6
TOTAL	108	100.0	61	100.0

At the University of Tennessee, Buehler (3), after a study of the grades made by all students taking one general chemistry course, reported in 1929:

- (1) Students with high-school chemistry make a better record during the first part of the work and they always stand a better chance of getting an A or B.
- (2) Students with no high-school chemistry have a better record during the latter portion of the work. (3:513)

Garard and Gates (5) reported in 1929 a study

at Rutgers University of 1,553 grades made in general chemistry by 216 different college students who had taken high school chemistry. The average grade of these students was 62.8 per cent while the average of 955 grades made by 133 students in the same classes, who had not taken the course in high school, was 53.8 per cent. Not only was the group average 9.0 per cent higher but the first group scored from 7.0 to 11.0 per cent higher on each examination.

A study at Northwestern University covering a ten year period was reported by Hines (8) in 1929. He found that the percentage of students passing first year college chemistry was 62 in the case of students presenting a unit of high school chemistry for admission and that this percentage dropped only to 61 for students without the unit of high school work.

After investigating the elementary college chemistry grades of 826 students at Marquette University, Herrmann (7) reported in 1931 that the acquisition of high school chemistry is advantageous to the college chemistry student, Table 2 (7:1,382). The students investigated were enrolled in three departments in chemistry courses taught by various teachers though essentially covering similar work during one semester.

Steiner (18) in 1932 reported the results of a study at Oberlin College, Table 3, and concluded that

Students who had high-school chemistry stand a better chance of making good grades in the first-year course than students without such preparation. (18:536)

Table 2.--PERCENTAGE DISTRIBUTION OF GRADES IN ELEMENTARY CHEMISTRY AT MARQUETTE UNIVERSITY.

	Semester grades				
	A	B	C	D	E & F
Students who have had high school chemistry	79	72	57	53	32
Students who have had no previous preparation	21	28	43	47	68
TOTAL	100	100	100	100	100

Table 3.--DISTRIBUTION OF GRADES IN ELEMENTARY CHEMISTRY AT OBERLIN COLLEGE. (18:533)

	<u>1st semester</u>		<u>2nd semester</u>	
	Number	Average grade	Number	Average grade
Students who have had high school chemistry	328	76.8	287	77.4
Students who have had no previous preparation	276	69.2	213	74.5

Data were collected from five colleges in Missouri for a study reported by Bray (2) in 1932. He found that 23.2 per cent of the students included in the investigation had studied chemistry in high school. Of

those who scored in the upper fourth of the Iowa Chemistry Training Test given at the beginning of the college chemistry course, 61.7 per cent had studied chemistry in high school. Of those who scored in the lower fourth of this test at the same time, 2.63 per cent had taken the high school course. When this same test was given at the conclusion of the college chemistry term, 49.3 per cent had studied high school chemistry who scored in the upper fourth and of those who scored in the lower fourth, 6.2 per cent had completed a course in high school chemistry. Bray concluded from the study that

Students who studied chemistry in high school tend to score higher on the Iowa Chemistry Training Test, both at the beginning of the term and at the end, than those of the whole group studied, though there is a definite tendency for that advantage to decrease during the term. (2:28)

Mills (14) asserted in 1934 after a study of the grades received by 500 students at the University of Buffalo that students who have had chemistry in high school do distinctly better work in elementary college chemistry than those who are taking it for the first time. He found, however, this advantage is not so evident during the second semester.

Smith (17) reported in 1939 that of 997 students at the University of Wisconsin who were taking a first course in chemistry and who had not taken high school chemistry, 56.67 per cent made grades of C or above. The same study showed that of 1,481 students taking the course

who had had high school preparation, 78.66 per cent made grades of C or better.

Secondary school physics  
and elementary college physics

Hunt (9), in 1925 noted much repetition when comparing physics textbooks at the George Washington University with those being used in the high schools of Washington. A comparison of grades made by students at the University showed that those students with a one year course in high school physics did slightly better than those who had not studied physics before, Table 4 (9:203). Hunt (9) concluded that

College grades in first-year college science courses indicate that students in these courses who have had preliminary work in the science in high school do slightly better than those who have not studied the science before. (9:207)

Table 4.--COMPARISON OF SEMESTER GRADES IN FIRST-YEAR COLLEGE PHYSICS AT GEORGE WASHINGTON UNIVERSITY.

Grade	With one-year high school course		With no preliminary course	
	Number	Per cent	Number	Per cent
A	1	2.2	1	2.5
B	7	15.6	2	5.0
C	11	24.5	11	27.5
D	15	33.3	12	30.0
E & F	11	24.4	14	35.0
TOTAL	45	100.0	40	100.0

Hurd (10) in 1930 reported a study at the University of Minnesota of the results of a locally devised test given to students of elementary physics during three terms. The test consisted of items found in all standard texts and all items which did not differentiate among excellent, average, and poor students as determined by their term grades were eliminated. He found that the difference in mean grades of students who had taken physics in high school and of those who had not was statistically significant in every case and stated that

There should, therefore, be no doubt that with the students here considered, the average student shows distinct outcomes from a course in high-school physics, in knowledge and ability to solve problems, peculiar to the course itself. (10:469)

First year college physics grades of students who had completed a high school course in the subject were distinctly better than the grades of those students who had not, Mill (15) reported in 1934. His study was confined to 500 students at the University of Buffalo, 201 of whom had not had contact with the science before college entrance.

Smith (17) found, at the University of Wisconsin, and reported in 1939 that of 92 students who had not had physics in high school, 65.21 per cent made grades of C or above. Of 363 students included in the study who had studied the course in high school, 65.81 per cent made C grades or better.



Other high school subjects and their college counterparts

Koos (12) asserted in 1925 after a study of economics textbooks used in 41 colleges and the texts used in 26 high schools that

Although the courses on the two levels are far from identical, they have enough in common to warrant concern as to the current practice of ignoring in the higher institutions the fact that a student has had the course in the lower school. (12:331)

In another study concerning economics, Marshall and Mills (13) in 1934 found that during the first semester of college economics there is a definite tendency for the high-school-economics group to secure higher grades. They found, however, that the difference is not statistically reliable and that the initial advantage is lost during the work of the second semester.

Boardman and Finch (1) reported in 1934 a study at the University of Minnesota of 139 students in the college of engineering and stated that

The analysis of these data seems to show that in three fields, science, mathematics, and manual training, there is a slight relationship between the amounts of high school credit and success in engineering courses. All three of these high school subjects contain one common element; they are all more or less closely related to engineering. (1:472-3)

Sarbaugh (16) in 1936 after completing a study involving articulation in English at the University of Buffalo stated as follows:

To recapitulate, the experimentation in anticipating college credit in English at the University of Buffalo seems to indicate there is no small amount of overlap between high-school and college work in this particular field. The amount of additional work which an able high-school senior must do in order to gain a creditable mark and four to six semester hours of college credit is certainly not excessive, and a technique for encouraging and directing such effort is relatively simple. (16:108)

In the field of biology, Smith (17) reported in 1939 that 78.75 per cent of 593 students who did not have biology in high school received grades of C or higher and that 78.66 per cent of 1,153 students who did study the high school course received comparable grades.

#### Drawing in high schools and colleges

Thorndike (19) in 1948 published the results of a survey of mechanical drawing in the high schools of Massachusetts which included teacher training, time allotment, textbooks, and subject matter. He stated that

The teacher preparation, while varying in degree, did not constitute a major problem. The large majority of teachers had a good technical background, and others, while not as well equipped technically, have a sound practical experience acquired in industry.

The time allotment was generally satisfactory in the cities and towns of over 5,000 population. In the towns of less than 5,000 population the time allotment was wholly inadequate and frequently the teaching time was divided between several towns and between classes in art and mechanical drawing.

The choice of textbooks indicated a very wide range of preference varying from the latest and most practical editions to those edited a gener-

ation ago. In the majority of cases a textbook was not available for each student in the class and therefore was used mainly for reference purposes.

The reports on subject matter indicated courses ranging from those which were very comprehensive and well organized to courses that were extremely superficial and contained little of real value.  
(19:15)

Irwin (11) in 1948 reported that of the students enrolled in the school of engineering at Oklahoma Agricultural and Mechanical College, 60 per cent had not taken a drawing course in high school, 18 per cent had taken a single semester of drawing, and 22 per cent had more than one semester of high school training in drawing.

In 1948, Worsencroft (20) reported the results of a study conducted during December, 1947, covering 37 colleges in all parts of the country. He estimated that only 38 per cent of the freshmen engineering students have had any high school drawing and states that, at the University of Michigan, four-sevenths of the students enrolled in elementary drawing have had none or less than one year of high school drawing and six-sevenths less than two years.

### Summary

The review of literature gave evidence to support the following conclusions:

1. In general, the college student who has had previous contact with a subject in high school tends

to make a somewhat better record when taking a duplicating college course.

2. This advantage, however, usually decreases during the second semester of the college course.

3. More work of a concrete nature should be done in determining the relation, contribution, and articulation in drawing between the high school and college.

### Chapter III

#### METHODS AND MATERIALS

In order to determine the relationship between grades in college engineering drawing made by students who have had no previous drawing experience and grades made by those who have taken drawing in high school, data on approximately 450 freshmen were studied. As far as the specific situation is concerned, that at the Agricultural and Mechanical College of Texas Annex, the cases contained in this study are not a sample. With the exception of a few students who were sick or otherwise not available at the time data on courses completed in high school were collected, all engineering drawing students at the Annex have been included. Registrants at the Annex include all regular first year students except those who are members of regular college athletic teams.

Semester drawing grades in numerical form were collected from the grade books of ten teachers in the Department of Engineering Drawing who taught all students included in the study. During the third and fourth weeks of May, 1949, the students were contacted while in their

engineering drawing classes and asked to complete check sheets concerning their previous drawing experience 1/. The information desired was carefully explained as well as the purpose of the study. All possible assistance was given in the correct completion of the check sheets. The data obtained included the following:

1. The students who had no drawing courses while in secondary school.

2. The students who had had commercial experience in drafting.

3. Semesters during which secondary school drawing courses were taken.

4. Kinds of drawing taken in secondary school, mechanical or architectural.

5. Names of schools, city, and state where courses were taken.

Teacher's grade books yielded the following additional information for each student concerned:

1. Numerical grades for 518 students completing Engineering Drawing 111, to be referred to hereafter as E. D. 111.

2. Numerical grades for 407 students completing Engineering Drawing 112, to be referred to hereafter as E. D. 112.

3. Numerical grades for 409 students

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1/ See Appendix C.

completing Engineering Drawing 124, to be referred to hereafter as E. D. 124.

Description of the college  
drawing courses

The subject matter covered during the first semester drawing course, E. D. 111, can be classified under the following headings:

1. Freehand sketching of blocks in multi-view and three view arrangement.
2. Engineering lettering, vertical.
3. Three view drawings.
4. Sections and conventions.
5. Primary auxiliary views.
6. Theory and practice of dimensioning.
7. Isometric drawings.
8. Oblique drawings, cavalier and cabinet.
9. Working drawings.

Headings which can be classified under E. D. 112 are as follows:

1. Pictorial production illustrations.
2. Charts and graphs.
3. Engineering lettering, inclined.
4. Threaded fasteners.
5. Detail and assembly drawings.

Areas taught in E. D. 124 include:

1. Problems not requiring the use of aux-

iliary views.

2. Problems requiring primary auxiliary views.
3. Problems requiring multiple auxiliary views.
4. Revolutions.
5. Intersections and developments.

Class time spent in E. D. 111 amounts to five and one-half hours per week for approximately eighteen weeks. This is the introductory drawing course, a prerequisite to E. D. 112 and E. D. 124, and is required for students majoring in Aeronautical Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Geological Engineering, Geology, Industrial Education, Management Engineering, Mechanical Engineering, Petroleum Engineering, Petroleum-Geological Engineering, Petroleum-Mechanical Engineering, Agricultural Engineering, and Landscape Design. Students taking E. D. 112 spend three hours and forty minutes in class each week during an eighteen week semester. This course is required in all of the curricula mentioned above except Agricultural Engineering, Geology, and Landscape Design. Descriptive geometry, E. D. 124, requires five and one-half hours of classroom work per week during a semester and is scheduled in all of the previously mentioned curricula except Landscape Design. Approximately 60 per cent of the



semester grade in each drawing course is determined from written examinations.

It was realized that, even though standardized courses of study were used and departmental examinations given, variations in teacher grading could influence the results of the investigation. After study of the distribution of students to teachers, however, it was decided to omit this factor, Tables 5, 6, and 7.

Table 5.--DISTRIBUTION OF STUDENTS TO TEACHERS IN ENGINEERING DRAWING 111.

Teacher	Students with no <u>high school drawing</u>		Students with <u>high school drawing</u>	
	Number	Per cent	Number	Per cent
A	26	8.5	14	6.6
B	49	16.1	40	18.8
C	45	14.7	31	14.5
D	53	17.4	30	14.1
E	39	12.8	45	21.1
F	8	2.6	4	1.9
G	28	9.2	20	9.4
H	46	15.1	17	8.0
I	11	3.6	12	5.6
TOTAL	305	100.0	213	100.0

Since E. D. 112 and E. D. 124 were taught only during the spring semester of the school year represented by this study, no student repeated these courses. E. D. 111 was taught during both the fall and spring semesters, however, and students who repeated this course are included.

Table 6.--DISTRIBUTION OF STUDENTS TO TEACHERS IN ENGINEERING DRAWING 112.

Teacher	Students with no high school drawing		Students with high school drawing	
	Number	Per cent	Number	Per cent
A	37	15.9	28	16.1
B	28	12.0	22	12.6
C	21	9.0	18	10.3
D	29	12.4	14	8.0
E	12	5.2	11	6.3
F	37	15.9	29	16.7
G	38	16.3	26	15.0
H	31	13.3	26	15.0
TOTAL	233	100.0	174	100.0

Table 7.--DISTRIBUTION OF STUDENTS TO TEACHERS IN ENGINEERING DRAWING 124.

Teacher	Students with no high school drawing		Students with high school drawing	
	Number	Per cent	Number	Per cent
A	43	18.3	26	14.9
B	23	9.8	11	6.3
C	22	9.4	24	13.8
D	22	9.4	21	12.1
E	37	15.8	31	17.8
F	12	5.1	12	6.9
G	28	11.9	13	7.5
H	39	16.6	28	16.1
J	9	3.7	8	4.6
TOTAL	235	100.0	174	100.0

In those cases, the grade obtained the first time the course was taken was the one used in calculating the mean grades. The second grade has been omitted from the investi-

gation since the student had then had preparation in drawing on the college level.

The data used in this study has been compiled in two groups, those students who have had drawing courses in secondary school and those without previous classroom contact with the field 2/.

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2/See Appendix A and B.

Chapter IV  
ANALYSIS OF DATA

Data for the determination of the effectiveness of secondary school industrial arts drawing were gathered from the grade books of college drawing teachers and from students by the use of check sheets. These data included numerical semester grades in three college drawing courses, the student's teacher in each of these courses, and the number of semesters of secondary school drawing completed by each student.

The data used in this study were analyzed by statistical methods in order to determine the mean grade of the group without secondary school drawing background, to be referred to hereafter as Group One; of the group which had completed as many as two semesters of secondary school drawing, to be referred to hereafter as Group Two; and of the group which had completed three or more semesters, to be referred to hereafter as Group Three. Statistical procedures were also used to determine the significance of the difference between uncorrelated means.

### Statistical procedures

In determining the mean semester grade of each group, a frequency distribution was first drawn up using class intervals of four. From this distribution the arithmetic mean grade was computed and, using this figure, the short method of calculating the standard deviation employed (6:49). It was then possible to find the standard error of the mean for each group. The standard error of the difference between uncorrelated means has been used in comparing the groups (6:211). A five per cent level of significance was assumed; thus, if the result of dividing the actual difference between means by the standard error of the difference between these means was greater than two, the means have been said to differ significantly.

### Secondary school drawing courses completed by students

Of the entire sample studied, 305 students or 58.9 per cent had not taken drawing in secondary school. Further examination of the sample showed that 131 students or 25.3 per cent had completed as many as two semesters of secondary school drawing and that 82 students, 15.8 per cent, had completed three or more semesters.

### Students without secondary school drawing background

Analysis of the grades made by students in Group One produced the measures found in Table 8. Of the

students in this group, 87.5 per cent made grades of 76 or better in E. D. 111. This percentage fell to 84.5 for students completing E. D. 112 and to 80.0 for students completing E. D. 124.

Table 8.--MEASURES DETERMINED FOR THE GROUP WITHOUT SECONDARY SCHOOL DRAWING BACKGROUND.

	E. D. 111	E. D. 112	E. D. 124
Mean semester grade	83.02	82.36	82.59
Number of cases	305	233	235
Standard deviation	6.64	6.52	10.04
Standard error of mean	.381	.427	.655

Students with as many as two semesters of secondary school drawing

Table 9 shows the measures determined from the grades made by students in Group Two. The percentage of students achieving numerical grades of 76 or higher in E. D. 111 was 97.8, in E. D. 112 was 86.8, and in E. D. 124 was 71.2.

Students with three or more semesters of secondary school drawing

The measures determined from the analysis of the grades made by students of Group Three are shown in Table 10. In E. D. 111, 96.4 per cent of the students in this

group made grades of 76 or higher. The percentage achieving grades in this area fell to 88.3 for students completing E. D. 112, and was 87.3 for those completing E. D. 124.

Table 9.--MEASURES DETERMINED FOR THE GROUP WITH AS MANY AS TWO SEMESTERS OF SECONDARY SCHOOL DRAWING.

	E. D. 111	E. D. 112	E. D. 124
Mean semester grade	85.13	81.36	80.78
Number of cases	131	114	111
Standard deviation	5.04	7.80	11.28
Standard error of mean	.440	.730	1.07

Table 10.--MEASURES DETERMINED FOR THE GROUP WITH THREE OR MORE SEMESTERS OF SECONDARY SCHOOL DRAWING.

	E. D. 111	E. D. 112	E. D. 124
Mean semester grade	87.06	83.90	85.69
Number of cases	82	60	63
Standard deviation	5.60	6.20	7.64
Standard error of mean	.618	.800	.962

#### Comparison of groups

The actual difference between the E. D. 111 mean grades of Group One and Group Two, 2.77, was found to be

statistically significant as was the difference, 4.70, between Group One and Group Three. Both these differences were indicative of virtual certainty. When Group Two was compared with Group Three, this difference, 1.93, was found to be significant also.

No statistically significant difference was found in the actual difference between the E. D. 112 mean grades of Group One and Group Two, 1.00, or in the actual difference, 1.54, between the grades of Group One and Group Three. The comparison of Group Two with Group Three, however, showed significance in the difference, 1.93, between these two groups.

In comparing E. D. 124 mean grades, no significance was noted in the difference, 2.54, between Group One and Group Two. The difference between Group One and Group Three, 3.10, as well as the difference between Group Two and Group Three, 4.91, was found to be significant.

### Summary

Analysis of the data showed that less than half, 41.1 per cent, of the sample studied had taken drawing in secondary school and that only 15.8 per cent had completed more than two semesters of secondary school drawing. It was also found that the percentage of students making grades of 76 or better in E. D. 111 was appreciably higher for students with secondary school drawing background than



for those without this preparation. In E. D. 112, this percentage was only slightly greater for students with drawing courses in secondary school than for those having no background.

Students who had completed two or more semesters of drawing in secondary school made a better record in E. D. 111, on the average, than students who had not taken the secondary school course. Those who had completed three or more semesters made an even better record in this college course.

The only significant difference in E. D. 112 mean grades was between those made by students who had completed as many as two semesters of secondary school drawing and those made by students who had completed three or more semesters.

In E. D. 124, students who had completed three or more semesters of secondary school drawing made a significantly higher mean grade than the group without background or the group with as many as two semesters in secondary school.

## Chapter V

### DISCUSSION

The implications resulting from a study of the relationship of the amount of drawing taken by a student in secondary school to grades made in college drawing courses seem to be significant in the light of several viewpoints. Articulatory, contributory, and guidance aspects as well as several others can be considered in this respect. The specific results of the present study have been logical and, in a general way, to be expected.

#### Articulation

Since articulation in education implies the segmentation of subject matter areas for any particular field, it can be said that this quality is not particularly good between the material taught in the secondary schools represented by the sample studied and the introductory college drawing course, E. D. 111, at the Agricultural and Mechanical College of Texas. If students who have had preparation in the field of drawing make a significantly better record in the college drawing course than students who have not

studied the subject in secondary school, other abilities and interests being comparable, repetition is probably involved. This repetition is, in one sense, a waste of time and energy for both the student and the teacher. If a student is capable of doing work beyond this introductory course at the time he enters college, his time might be better spent in more advanced work where he could learn new material. The fact that he is qualified to take advanced work in drawing on the college level could probably be determined by using satisfactory anticipatory examinations. If such a plan were open to high school students who enter college in engineering or closely allied major courses, they could feasibly elect high school drawing courses which would allow omission or substitution of elementary college work in this field.

The degree of articulation between secondary school drawing and E. D. 112 could not be clearly ascertained from the results of the investigation. One probability is that whatever knowledge students with previous preparation obtained in secondary school drawing relative to this college course was also obtained to a large extent by the other group while actually taking the college course. It is also possible that over-confidence on the part of students who had completed as many as two semesters of drawing in secondary school was a factor which caused the mean grade of this group to fall below the mean grade of

the group without previous preparation. Boredom and repetition might also have been contributing factors in relation to the achievement of this group.

Articulation between secondary school drawing and E. D. 124, descriptive geometry, is evidently not particularly good when the mean grade of the group without secondary school drawing background is compared with that of the group which had completed three or more semesters in secondary school. It seems possible that in this case, however, a selection factor was operating. Those students who had completed three or more semesters were probably more interested, on the average, in drawing than other groups as evidenced by the amount of secondary school work done in the field.

### Contribution

From the standpoint of student preparation and his advantage in college drawing grades, secondary school drawing can be considered valuable. This is particularly true in regard to the introductory college drawing course. A slight advantage which decreases during the semester is to be seen when the two second semester courses are examined. Although marked by repetition of subject matter and inefficient articulation, this advantage during the first semester might, in certain instances, be much desired. The results of the study seem to indicate that most of the

drawing courses in secondary schools from which the Agricultural and Mechanical College of Texas drew its 1948-49 enrollment are effective to the extent of making significant contributions in the preparation of college engineering students. The results were also closely comparable to those reported by the investigators already reviewed.

### Guidance

In most cases, the mere fact that a student has taken a course in drawing in secondary school is a positive step toward better guidance for that student. The resulting grade advantage in college drawing courses, as evidenced by this study, seems also to be useful. In instances where a student is apparently capable of completing a college course in engineering but lacks the self confidence to undertake the task, the advantage in college drawing grades gained by taking secondary school drawing courses could furnish the necessary encouragement. This might also help to make the transition from high school to college, which many students find difficult, an easier experience. Cole (4) and other investigators have reported that first semester college grades are indicative of those a student will continue to get during his college career. For these reasons, the acquisition of secondary school drawing is apparently to be desired.

More occupational information at the high school

level could have the effect of raising the percentage of students who take drawing courses in secondary school and enter college courses requiring work in this field. The percentage of prepared students determined by this study was in agreement with the percentages reported by Irwin (11) and Worsencroft (20) in 1948.

#### Suggestions for further study

The results of this investigation seem to indicate that more work should be done in the field of articulation in drawing between high school and college. A study of the contribution of high school drawing to college drawing courses covering a period of years should prove helpful in this respect.

Further studies might be made concerning the anticipation of college drawing by using anticipatory examinations.

It is possible that a correlation of the results of a mechanical aptitude test with college drawing grades would prove valuable.

An overall study of high school courses in drawing by geographical areas should do much toward unifying the work done in this subject.

Perhaps a study of the contribution of the entire field of high school industrial arts to similar courses in college would improve this area on both levels of instruction.

## Chapter VI

## SUMMARY

For the student who plans to enter college, the choice of high school courses which will be of most value is a problem. Often the student lacks the necessary job information to make a wise decision. A large percentage of students who register in curricula requiring courses in engineering drawing at the Agricultural and Mechanical College of Texas have not had high school preparation in this field. The present study was undertaken in order to determine whether the grades in college engineering drawing courses made by students who have had no secondary school preparation in drawing differ significantly from the grades made by students who have taken courses in industrial arts drawing while in secondary school.

Data were collected from college drawing teachers and from approximately 450 freshman students. These data included numerical semester grades in three college drawing courses and the number of semesters of secondary school drawing completed by each student. Statistical methods were employed in the computation of mean semester grades

for each engineering drawing course of three groups of students, those with no secondary school preparation in the subject, those who had completed as many as two semesters of secondary school drawing, and those who had completed three or more semesters in secondary school.

It was found that students with as many as two semesters of high school drawing preparation make a significantly better record, on the average, in the introductory college drawing course than those without this preparation. Students who had completed three or more semesters of high school drawing made an even better record in this course. Advantage was not so evident in the two second semester college drawing courses.

Approximately 41 per cent of the sample studied had taken drawing in secondary school and only 16 per cent had completed more than two semesters of secondary school training in the subject.



A P P E N D I X

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Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
1	80	C	80	F	84	B
2	72	B	86	B	86	C
3	87	C				
4	80	D	80	F	85	E
5	87	C	89	C	84	G
6	87	D				
7	65	D	60	F	72	E
8	80	D	73	F	82	D
9	89	C				
10	84	B	80	F	80	F
11	87	D	70	B	78	D
12	87	A	80	F	92	E
13	74	B				
14	84	C	89	E	98	H
15	66	B				
	87	F (repeat)				
16	80	B			76	B
17	87	D			76	A
18	79	B	73	F		
19	80	B	80	F	73	F
20	80	A	82	A	85	E
21	87	D	86	G	97	D
22	80	D	73	H	76	H

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	E. D. 111 Teacher	E. D. 112 Grade	E. D. 112 Teacher	E. D. 124 Grade	E. D. 124 Teacher
23	82	B	80	D	88	A
24	87	F	93	A	80	G
25	87	D	85	C	87	B
26	80	D	77	G	88	G
27	89	B	87	D	92	H
28	75	B	73	F	70	E
29	80	D	73	F	66	H
30	80	A	75	A	77	A
31	96	C			87	B
32	71	A	74	G		
33	80	B	80	F	89	B
34	82	C	73	D	89	H
35	87	D	80	F	87	F
36	69 87	B F (repeat)	79	E		
37	87	D				
38	85	C	73	F	60	F
39	80	D	60	F	92	C
40	87	C	82	A	96	H
41	83	B	80	F	83	E
42	77	G	80	H	79	B
43	90	B	87	F	87	F

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	E. D. 111 Teacher	E. D. 112 Grade	E. D. 112 Teacher	E. D. 124 Grade	E. D. 124 Teacher
44	64 80	B C (repeat)				
45	87	C	73	A	74	E
46	73	D				
47	87	H	73	F	93	B
48	96	A	92	E	96	E
49	87	C	80	H	75	E
50	87	C			80	A
51	92	C	86	G	96	D
52	87	C	87	H	88	A
53	96	E	93	B	93	E
54	87	I				
55	76	C	76	C	67	B
56	87	A	87	D	72	E
57	80	C	80	D		
58	80	H	80	H	65	E
59	87	H	96	D	84	G
60	80	H	87	C	67	H
61	87	A	80	F	62	B
62	80	H			78	J
63	87	H	80	G	80	H
64	87	H	80	F	94	E

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
65	96	D	92	G	92	H
66	80	C	86	E	81	A
67	80	H	87	C		
68	87	E	74	G		
69	87	H	80	B	70	A
70	87	H	73	F		
71	75	A	80	F	78	B
72	80	E	79	A		
73	87	D	82	A	51	D
74	80	H	60	F	49	B
75	96	E	87	H	98	C
76	87	E			76	G
77	87	E	80	F	87	D
78	87	D				
79	87	E	80	D	82	A
80	87	E	87	H	85	C
81	80	C	80	H	80	E
82	87	F				
83	73	E	60	D	65	A
84	80	C	73	D	79	A
85	87	H			86	J

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124	
	Grade	Teacher	Grade	Teacher	Grade	Teacher
86	80	H			75	J
87	96	H	87	D	97	J
88	80	H	96	G	96	J
89	80	H	75	A		
90	87	H	87	H	93	H
91	80	D	78	E	63	A
92	73	D				
93	80	H	85	G	88	A
94	87	H	82	E	73	E
95	80	H				
96	96	C	92	A	98	D
97	87	H	86	G	84	E
98	91	C				
99	87	H			93	J
100	87	D	83	G	60	G
101	87	H	82	B	78	J
102	70	B				
103	71	D			74	E
104	87	H	82	G	96	D
105	87	D	82	A	87	B
106	87	H	92	C	96	H

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
107	87	H	78	A	73	B
108	80	H	89	C	82	H
109	96	H	87	G	93	G
110	86	E				
111	80	H	85	C	72	E
112	65 87	B F (repeat)				
113	80	D				
114	96	E	84	B	87	F
115	85	B	83	C	80	E
116	80	B	80	F	89	B
117	71	A	74	G	76	G
118	71	B	85	A	81	A
119	87	C	85	A	86	A
120	80	F				
121	80	E	82	B	80	F
122	81	B	82	A	88	H
123	87	E	80	F	96	F
124	87	D	80	F	96	F
125	86	B	76	A	86	C
126	75	B	80	H	92	H
127	87	E	87	D	89	A



Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
128	79	G	87	H	77	E
129	81	G	80	D	54	H
130	87	E				
131	87	B	92	B	97	D
132	80	A			61	H
133	73	E	80	H	76	H
134	87	H	80	D	74	G
135	86	B	80	G	87	F
136	80	H	81	A	81	A
137	87	C	79	G	86	A
138	80	E	80	B	86	C
139	96	E	80	H	76	H
140	87	E	80	F	87	F
141	96	D	96	H	92	H
142	96	F				
143	87	D	81	A	87	F
144	87	E	79	B	88	C
145	80	H	87	D	70	H
146	76	B	80	D	70	H
147	86	B	84	B	85	B
148	87	C	93	C	79	G

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
149	87	D	87	H	89	H
150	87	B	80	F	92	E
151	73	D				
152	87	E				
153	73	E			73	E
154	83	G	73	F	81	E
155	77	G	87	H		
156	88	B	88	B	91	D
157	87	H	80	D	76	H
158	78	B	80	D	76	H
159	87	E			90	G
160	78	B	86	A	87	A
161	87	D	80	H	76	H
162	87	F				
163	80	C	80	G	62	G
164	80	B	78	G	78	E
165	80	E	80	F		
166	82	I	73	F	77	E
167	77	B			70	G
168	87	A			80	A
169	71	D	73	A	72	G

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
170	80	C	81	C	83	B
171	85	D				
172	83	G	84	B	88	C
173	87	H	91	E		
174	78	G	76	G	67	A
175	81	G	80	F	77	A
176	71	A	70	G	70	G
177	87	C	88	G	93	A
178	80	H	80	D	81	A
179	87	H	60	D	85	A
180	75	B			71	G
181	87	C	80	H	88	A
182	80	D	87	H	67	J
183	87	H	89	G	93	H
184	87	A	80	D	85	G
185	79	I	84	B	95	D
186	59 87	A C (repeat)				
187	85	E				
188	78	E				
189	96	D	87	B	93	C
190	87	H	84	A	88	E

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	E. D. 111 Teacher	E. D. 112 Grade	E. D. 112 Teacher	E. D. 124 Grade	E. D. 124 Teacher
191	87	C	80	D	79	A
192	80	B	89	B	76	H
193	80	C	87	D	85	A
194	87	C	84	B	85	C
195	80	H	82	G	83	H
196	87	H	80	H	81	A
197	86	E				
198	88	I	81	B		
199	80	D	80	D	84	C
200	87	H	88	C	85	A
201	87	C				
202	87	C	84	E	82	G
203	80	E			91	E
204	80	H	87	H	76	H
205	96	F				
206	87	C	60	D	71	B
207	96	C	87	F	96	H
208	90	E				
209	87	D	85	C	78	B
210	87	D	86	C	89	E
211	80	D			77	B

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
212	96	E	88	C		
213	87	E	85	C	88	G
214	88	E				
215	80	F				
216	87	H	78	G	89	H
217	96	D	87	H	90	H
218	73	D				
219	75	B	85	B	87	D
220	80	C	80	B	90	C
221	80	H	81	C	75	J
222	80	H	68	A	84	E
223	87	E	79	A	84	A
224	81	I	86	B		
225	89	B	91	C	90	B
226	85	B				
227	73	G	75	G	57	B
228	87	C			86	C
229	87	B	82	G	87	G
230	79	B	80	H	85	C
231	90	B	87	D	88	A
232	85	B	85	G	85	G

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
233	60	D				
	82	C (repeat)				
234	84	G	89	C	92	E
235	96	H	87	E	93	H
236	81	A	74	A		
237	87	E	87	D	87	C
238	70	G	74	G	88	D
239	71	D	73	A		
240	78	G	85	A	73	G
241	78	G	86	G	65	A
242	80	F				
243	79	G	85	A	65	E
244	84	G	85	G	87	A
245	96	C	87	H	81	E
246	85	G	89	A	85	A
247	77	B				
248	81	G	85	E	80	A
249	84	B	87	H	83	H
250	86	G	80	G	81	G
251	69	G				
	83	C (repeat)				
252	73	B				

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
253	80	E				
254	87	D	87	D	77	B
255	87	D	90	E	76	H
256	80	F				
257	83	G	86	C	88	G
258	83	E				
259	82	G	88	A	77	A
260	80	C	79	A	76	G
261	70	G	82	A	63	A
262	87	E	80	H	79	G
263	77	G			84	D
264	86	B	91	G	95	C
265	96	C	82	G	93	D
266	84	G	81	G	81	A
267	96	E			89	A
268	85	B	85	G	97	C
269	80	C	72	A	62	E
270	87	E				
271	71	A	80	H		
272	86	G	83	G	86	A
273	78	G	80	D	90	C

Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
274	78	G	96	D	93	A
275	91	G	89	A	81	G
276	82	A	81	E	85	C
277	81	I	87	B	95	C
278	80	A	78	G	71	A
279	86	I	81	B		
280	96	A	96	H	89	H
281	87	D				
282	80	I	73	F	83	E
283	87	D	96	H	93	A
284	81	I	80	A	77	D
285	80	A	82	A		
286	73	D				
287	87	B	89	C	88	E
288	80	D				
289	87	A	88	B	90	C
290	87	D				
291	80	D				
292	87	C	80	F	94	E
293	80	I	89	H	85	H
294	80	D	73	F	75	E



Appendix A.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WITH NO PREVIOUS DRAWING EXPERIENCE.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher
295	71	A	81	A	57	D
296	87	A	88	B	92	D
297	87	D	82	G	95	D
298	80	D	77	B	84	D
299	96	A	88	A	97	B
300	87	I	89	B	93	C
301	87	A	93	A	96	G
302	87	D				
303	80	A	80	H	84	H
304	80	C	73	F	76	D
305	72	B	89	B	92	D
306	87	D			76	H

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
1	81	B	80	G			2
2	76	B	76	B	86	C	2
3	89	B	80	F	91	B	1
4	79	B	87	H	74	D	4
5	94	B	92	B	93	C	4
6	82	B	81	G			2
7	90	B	81	A	97	C	2
8	80	A	80	F	80	F	6
9	85	B	73	F	60	F	2
10	87	D	80	F	89	E	4
11	87	D			91	E	4
12	87	D	79	G			1
13	83	B	80	F	88	E	2
14	90	C	88	D	85	C	2
15	87	D	80	F	92	E	2
16	88	B	80	D	86	A	6
17	85	B	87	H	79	H	2
18	83	C	73	A	80	H	4
19	92	C	87	F	96	F	2
20	88	C	87	D	92	H	6
21	83	E					6

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111 Grade	E. D. 111 Teacher	E. D. 112 Grade	E. D. 112 Teacher	E. D. 124 Grade	E. D. 124 Teacher	Semesters of high school drawing
22	87	F					2
23	89	C	87	H	90	H	2
24	87	C			63	E	2
25	87	I	87	F	96	E	2
26	93	B	96	F	91	E	4
27	87	E	78	G	73	A	2
28	87	E			89	C	4
29	85	E					4
30	87	C	79	G	79	H	4
31	96	C	86	G	91	A	3
32	87	C	80	D	76	A	2
33	87	E			81	A	6
34	87	D	80	F	90	H	2
35	80	E	70	A	43	B	2
36	87	H	84	B	87	H	2
37	96	E	87	D	92	G	5
38	96	E	87	D	94	A	2
39	87	D	80	F	85	G	2
40	87	H	80	C	68	J	2
41	87	H	87	C	81	H	4
42	80	F					1

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher	Semesters of high school drawing
43	80	D	78	C	66	B	2
44	87	E	80	H	87	D	1
45	87	E	87	H	87	D	2
46	87	D					4
47	87	C	84	A	95	D	1
48	87	D	80	H	72	H	2
49	96	D	85	C	87	B	4
50	80	C	72	A	66	D	2
51	80	E	80	H	63	A	1
52	87	H	84	B	82	H	2
53	87	H			96	B	3
54	87	C	84	G	87	G	2
55	87	D					6
56	94	B					2
57	87	H			76	G	2
58	87	H	73	G	60	H	4
59	87	H	88	C	81	A	2
60	80	E	75	A	71	A	2
61	89	E					4
62	96	E	80	H	82	C	3
63	87	E	74	A	85	B	1

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
64	87	H	82	G	94	D	2
65	96	C	72	G	74	A	2
66	96	H	86	G	93	D	6
67	87	C	76	A	83	A	2
68	87	E	87	D	86	C	2
69	91	B	80	F	94	E	6
70	83	B	89	B	88	D	2
71	80	C	52	A	55	C	2
72	87	A	89	E	80	G	2
73	87	C	72	A	88	C	3
74	96	E	87	F	87	F	4
75	96	C	87	F	91	E	2
76	82	B	81	A	94	C	2
77	87	D	80	F	87	F	4
78	87	E	83	C	70	H	2
79	83	G	80	H	63	H	2
80	87	E	84	B	94	J	6
81	87	D					2
82	96	E	80	F	70	H	8
83	87	H	87	D	90	H	2
84	89	E					6

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
85	96	I	87	F	96	F	2
86	76	B	76	A			1
87	87	E	80	F	87	F	2
88	84	G			92	E	6
89	89	B	80	F	88	E	4
90	89	E					1
91	90	E					6
92	87	C	60	F	60	F	1
93	88	B	81	B	88	C	2
94	87	E	89	E	78	E	2
95	80	E	82	E	73	F	2
96	93	G	87	F	94	E	4
97	96	D					1
98	87	H	80	D	73	H	2
99	86	B	79	G	71	D	2
100	96	F					2
101	87	D	80	H	79	H	3
102	96	E	93	A	93	H	4
103	90	E					6
104	77	B	87	H			1
105	87	D					2

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111 Grade	Teacher	E. D. 112 Grade	Teacher	E. D. 124 Grade	Teacher	Semesters of high school drawing
106	87	C	80	G	84	A	1
107	89	I	88	C	92	E	3
108	93	I	92	B	92	D	2
109	96	E	96	D	76	H	2
110	80	D	78	G	76	D	2
111	87	E	83	E	73	G	4
112	80	B	84	E	84	E	2
113	80	C	79	G	84	D	2
114	83	B	75	G	84	B	2
115	87	I	80	F	91	E	4
116	85	C					1
117	77	B	82	C			4
118	88	I	80	F	93	B	3
119	90	E					3
120	87	D	96	B	85	C	3
121	93	B	88	B	92	C	4
122	87	H	76	G	84	H	2
123	80	D	42	E	66	H	2
124	80	E	76	G	76	G	4
125	85	G	84	B	92	C	2
126	86	E					3

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
127	87	I	80	H	79	E	6
128	80	H			86	B	1
129	81	E					4
130	82	I	96	H	85	E	2
131	73	B	70	A			4
132	91	A	89	A	89	G	2
133	87	H	87	H	83	E	2
134	87	I	87	F	88	E	8
135	88	B	88	B	91	D	4
136	96	E	90	A	90	A	2
137	80	I	87	B	82	H	2
138	87	D			74	A	2
139	89	B	57	B	79	J	1
140	82	B					6
141	91	B	96	D	89	H	4
142	80	E	87	H	75	E	2
143	87	C			61	B	1
144	87	D	87	H	82	A	6
145	87	C	85	C			2
146	90	G	87	H	88	E	2
147	87	E	86	E	65	G	2



Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
148	83	B	81	G	85	C	2
149	79	B	65	A			2
150	83	E					7
151	92	G	78	C	95	J	5
152	92	G	90	B	88	E	2
153	80	C	80	H	48	C	2
154	87	G	76	G	80	G	2
155	89	C	85	A	71	A	4
156	91	B	88	B	87	H	3
157	87	C	80	H	60	H	1
158	75	G	74	A			3
159	86	G	87	H	87	A	8
160	87	E	73	D	87	C	4
161	81	G	73	G	76	G	2
162	90	G	92	G	87	A	2
163	87	D	87	F	87	F	2
164	80	D			70	J	2
165	87	A	79	C	69	E	2
166	90	B	91	C	91	E	3
167	87	G	92	C	95	A	4
168	82	G	87	H	96	D	2

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
169	80	E	87	D	84	C	2
170	87	D	78	C	74	B	2
171	82	B	79	A	80	F	1
172	87	D	82	A	86	J	3
173	93	B	92	E	95	C	2
174	88	G	79	A	93	C	2
175	85	G	88	C	89	J	2
176	87	E	82	A	86	G	2
177	87	E	83	G	85	C	2
178	78	B					1
179	87	C	81	A	87	D	1
180	90	G	92	E	85	A	4
181	87	F					4
182	87	C	76	A	82	A	5
183	87	H	87	H	94	D	4
184	87	A	89	E	95	A	2
185	72	G	87	F	73	G	2
186	87	E	87	H	90	H	2
187	89	G	87	C	86	A	4
188	78	G			91	E	3
189	68	A					
	82	C (repeat)					3

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
190	87	A	79	C	88	A	1
191	87	A	88	E	92	D	3
192	87	C	81	A	84	A	2
193	87	E	78	G			2
194	87	E	73	H	63	E	1
195	87	A	82	G	84	H	2
196	80	I	79	A	77	H	2
197	87	C	73	F	69	D	6
198	70	B	66	D			2
199	96	H	76	C	74	E	5
200	66	A					
	88	C (repeat)					2
201	87	A	85	H	78	E	2
202	78	I	87	H	72	E	2
203	87	D					6
204	87	A	84	B	88	C	4
205	87	C	85	B	80	C	3
206	87	D	80	F	95	E	1
207	80	A	84	B	90	C	2
208	87	D	87	F	80	F	2
209	87	D	86	B	85	D	2

Appendix B.--VARIATES USED IN THE STUDY OF THE 1948-49  
 SAMPLE OF STUDENTS WHO HAD DRAWING IN SECONDARY SCHOOL.  
 --Continued.

Case Number	E. D. 111		E. D. 112		E. D. 124		Semesters of high school drawing
	Grade	Teacher	Grade	Teacher	Grade	Teacher	
210	86	B	82	B	92	D	1
211	85	B	87	B	72	J	4
212	80	D	77	G	63	D	2
213	87	A	84	A	86	A	3

Appendix C.--COPY OF CHECK SHEET USED IN COLLECTING DATA  
FROM STUDENTS.

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\_\_\_\_\_ , \_\_\_\_\_

Last name

\_\_\_\_\_

First name

\_\_\_\_\_

Middle name

Please list in the correct space provided below the Mechanical Drawing or Drafting courses that you have completed in secondary school. If none, check here . . . \_\_\_\_\_

1943-44 Fall : \_\_\_\_\_

Spring : \_\_\_\_\_

1944-45 Fall : \_\_\_\_\_

Spring : \_\_\_\_\_

1945-46 Fall : \_\_\_\_\_

Spring : \_\_\_\_\_

1946-47 Fall : \_\_\_\_\_

Spring : \_\_\_\_\_

1947-48 Fall : \_\_\_\_\_

Spring : \_\_\_\_\_

Commercial experience: \_\_\_\_\_

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\_\_\_\_\_

Name of school

\_\_\_\_\_

City

\_\_\_\_\_

State

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