NON-VOCATIONAL COURSE CONTENT IN GRAPHIC REPRESENTATIONS

THESIS

NON-VOCATIONAL COURSE CONTENT

IN

GRAPHIC REPRESENTATIONS

Submitted by William R. Cleveland

In partial fulfillment of the requirements for the Degree of Master of Science Colorado State College

of

Agriculture and Mechanic Arts Fort Collins, Colorado

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Chapter I INTRODUCTION

Modern trends in education and the demands of every-day life make it imperative that all courses included in a high school program be under constant revision. We cannot assume that a course once valuable will always be valuable. Non-vocational courses should be recognized as such and their content so organized.

The pupils who enroll in mechanical drawing in the Downers Grove High School, Downers Grove, Illinois, do not, in most cases, engage in drafting occupations after they leave school; therefore, the course should be designed to meet their needs as pupils, parents, and citizens. The course, as it is taught at present, is designed to develop draftsmen. It has been organized to correlate with woodworking and metalworking, although many of the pupils do not enroll in these industrial arts subjects. It is important that the drawing work should be correlated with the school work which the pupils are doing; therefore, it should correlate with more subjects in the school curriculum.

Several men have made surveys for the purpose of determining the content of mechanical drawing courses (3, 5, 7, 10, 12), and their findings indicate that the

addition of new content or a change of emphasis on parts of the old content is needed. This is evidence that a change is needed in our present mechanical drawing courses. Some of the newer textbooks (2, 6, 8, 14,) in mechanical drawing have included units which the writers consider to be of more value to the average citizen than some of the units in the old traditional courses. Some of these units deal with making charts, graphs, free-hand sketches, and maps.

The problem of discovering what should be included in a course of study is in the field of curriculum construction. Organizing a course in mechanical drawing brings the study into the field of industrial arts, and inasmuch as this course is to be designed for high school students, it becomes one in secondary education. An important basis in developing any course of study is to make it fit the present and future needs of the individual. Although the needs of pupils are, in general, about the same, it seems more advisable to discover the present and likely future needs of the pupils for whom the course of study is designed. It is upon this basis that the study was made.

Thus, the problem of this thesis is: A study of the uses made of different kinds of graphic representation by the citizens of a residential suburb of a large commercial and industrial city, using as a type, Downers Grove, Illinois, a suburb of Chicago, Illinois, for the purpose of establishing a non-vocational course in the high

school dealing with graphic representations.

The term "graphic representation" has been selected rather than the term "drawing" because of the narrow meaning often given to the latter. Drawing is usually thought of as pertaining to mechanical drawing or artistic drawing or both, but it is not thought of as including charts, graphs, diagrams, maps, and sketches. According to the definition of drawing, as found in Webster's New International Dictionary (13), the term itself is broad enough to include everything that should be included. It states that "drawing is the art of delineation or of portrayal by means of lines." However, since this is not the meaning which the average person gives to drawing, the writer used the term graphic representation which will include all types of mechanical drawing as well as charts, graphs, diagrams, maps, designs, mottoes, and free-hand sketches of various kinds.

The basis upon which the non-vocational course will be established is the uses revealed from the study. The aim of the course is: to give the pupil training in reading and making the different kinds of graphic representations which the average citizen uses today. The writer is aware of the fact that there are other objectives for the usual mechanical drawing course (11), and, no doubt, some of these other objectives can be fulfilled in the course of study that is finally proposed. However, no attempt will be made to show how the other objectives can

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be achieved in the proposed course.

In working out this problem the following questions must be answered:

- 1. What is graphic representation?
- 2. How does the average citizen use graphic representation?
- 3. What are the different kinds of graphic representations?
- 4. What is the content that comprises a course of study?
- 5. What should be the organization of the course of study?

The proposed course of study is presented in

outline form. No attempt is made to set up methods by which the various units should be taught. Neither are any exercises or plates proposed, nor does the element of time required to present each unit enter into consideration.

Chapter II

REVIEW OF RESEARCH LITERATURE

In preparation for carrying on this study a review of similar studies was made. There are several closely related to it.

An investigation was made by Mr. F. W. Walsh in 1928 of the uses of mechanical drawing in every-day home life (12). Through a questionnaire sent to parents he learned whether they performed daily, frequently, seldom, or never certain activities at home involving the use of mechanical drawing or a knowledge of it.

His study revealed that (a) laymen made general use of mechanical drawing and the knowledge that it involves; (b) there was a general lack of training in mechanical drawing, and a short course in mechanical drawing fundamentals should be offered to all students during the junior high school period; (c) mechanical drawing should be considered in the scheme of general education.

An analysis of home activities was carried on in the Denver Public Schools in 1923 (9) for the purpose of including in the various industrial arts courses training for these activities. However, this survey failed to include an analysis of activities involving any type of drawing. Their analysis did not result in a separate drawing course, because they concluded drawing should be related to other school subjects.

The mechanical drawing occurring in eleven widely read magazines was analyzed in 1929 by Mr. C. A. Rosell (10). The findings formed a basis for a course in mechanical drawing for persons not expecting to use such training for vocational purposes. The following types of mechanical drawing were considered: machine parts, woodworking projects, sections of all kinds, and architectural drawings. It was also found that architectural drawings appeared in more of the magazines than did other mechanical drawings. From other parts of the study it was concluded that a nonvocational course should include a group of problems in orthographic projection showing views in relation to one another in various combinations of the top, front, and end views. Machine parts and woodworking projects should form a goodly portion of the problems. Assembly drawings and sectional views should be included in the course as well as construction of lines and dimensioning. In the architectural field the reading of drawings in plan form should be the chief objective.

This thesis showed in a scientific way the features or elements which should be included in the part of a course of study dealing with orthographic, or working drawings, and architectural drawing.

Industrial drawings contained in seven magazines which were read most frequently by junior high school boys in four Ohio communities were analyzed in 1932 by Mr. A. M. Hoffman (7). This study found that 65 per cent of the boys read a magazine which contained industrial drawings on 28 per cent of its pages, while 55 per cent of the boys read another magazine which contained industrial drawings on 32 per cent of its pages. Also 65 per cent of these drawings were in orthographic projection, and 88 per cent of the drawings in orthographic projection were shop drawings. Of these shop drawings 70 per cent were included under the following four classifications: furniture, electrical, sheet metal, and machine drawings.

These findings show the need for an extended analysis of drawings appearing in literature for the purpose of organizing a broader course of study in drawing.

Five copies of newspapers and 15 copies of magazines were studied by Mr. O. A. Hankammer (5) to determine the amount and kinds of drawing they contained. He found that 28.5 per cent of the newspaper and magazine space was given to drawing. From this study he concluded: (a) that drawing had enough appeal and instructional value to be given more serious consideration in textbooks, public school curricula, and general educational methods; (b) that the data seemed to justify the establishment of two types of courses in drawing, namely: basic interpretative instruction for the rank and file of pupils and specialized courses with a vocational aspect; (c) that drawing instruction should be diversified as to types of drawing and that instruction should not be based on abstract exercises; (d) that all pupils have a need for the minimum understanding of graphic representation.

A study was made by Mr. W. P. Hale in 1932 "to determine, if possible, what should constitute the content of a mechanical drawing course designed to teach pupils how to read, understand, and how to make the drawings which they were most likely to meet or need in every-day life." (3) He reviewed 102 newspapers, 60 magazines, 126 mailed advertisements, and 158 school library books to discover how frequently drawings occurred in them. He also tabulated the space taken by the drawings. Any type of graphic representations which were produced in a drafting room were considered as a drawing.

It was concluded that some form of drawing was needed in nearly every walk of life, and as a daily experience the majority of people need a knowledge of reading and understanding drawing. The kinds of drawing found to be important were: pictorial drawings, freehand sketching, orthographic projections, sections, mottoes and emblems, lettering, diagrams and charts, outdoor drawings, graphs, silhouettes, line maps, architectural drawings, geometrical constructions, wiring diagrams, developments, elevations, conventions, and patent drawings.

These studies have been based on parents' and pupils' use of drawings in home life, drawings found in magazines and newspapers, and the space drawings occupy in newspapers, magazines, mailed advertisements, and school library books.

However, none of these include all three groups which are surveyed in this study, nor are all elements of the problem so definitely related to one community and its needs.

Attention is also called to the fact that six years of great industrial growth has elapsed since the last of these studies was made. During this time the need for a course, such as proposed, has become more evident.

Chapter III MATERIALS AND METHODS

To secure the data needed for solving the problem, three groups of people were called upon. The first source was the parents of the pupils in the Downers Grove High School. Since the results of this study will be used to improve the curriculum in the high school it was assumed that this group of people would be more willing to cooperate by furnishing the data desired. Many of this group work in Chicago and live in Downers Grove. Their occupations are as varied as one expects such a group to be. This is shown by the fact that the group of parents used in the study gave their occupations as: 21 metalworkers, 16 building trades workers, 11 railroad employees, 9 office workers. 8 electrical workers, 8 in retailing, 5 workers in the automobile industry, 4 mechanical engineers. 3 salesmen, 3 farmers, 3 tailors, 3 unemployed, 2 printers, 2 government inspectors, 2 housewives, and 1 each of the following: doctor, artist, professor, janitor, nurseryman, truck driver, werehouse worker, fire protection engineer. and price engineer. Most of these people have reached the point in life where it would seem that they have already found a use for graphic representation if they are ever going to use it.

The second source of information was alumni who had studied mechanical drawing some time during the years 1930-1938. It was assumed that these younger men would be more likely to read newer literature than the parents. The occupations of this group are also varied: 11 are at present attending college or technical school -- two of these 11 are employed part-time, one as a road man for the United States Geologic Survey and the other as a shop hand. Of the remaining 34, six are employed in some line of electrical work, five work in machine shops, four are unemployed, and one each is employed as: embalmer, auto mechanic, mink rancher, nurseryman, inspector, gas attendant, assistant patrolman of highways, sheet metal worker, draftsman, grocery clerk, artist engraver, office clerk, aeronautical engineer, chemical engineer, railroad worker, and surveyor's helper. They are more familiar with the present mechanical drawing course, hence, are more likely to offer pertinent suggestions for the improvement of the course. Furthermore, they have had mechanical drawing, and, therefore, they are better able to recognize possible uses of drawing or graphic representation than a parent who has not had such training.

The third source of data was the teachers in the school. These teachers are familiar with the ways in which the pupils have opportunity to make use of graphic representation in their classes and hobby clubs. The following list of school subjects taught by the teachers inter-

viewed indicated a broad curriculum: English, French, Latin, Spanish, Current European History, World History, American History, Civics, General Mathematics, Algebra, Geometry, General Science, Biology, Chemistry, Physics, General Shop, Woodworking, General Business, Bookkeeping, Typewriting, Commercial Law, Stenography, and Art.

The data were gathered from the parents and alumni by the use of a questionnaire; the same questionnaire was used for both groups. The data were obtained from the teachers by means of personal interviews.

The content of the questionnaire was developed from the findings of Hale's study (3), questions used by Walsh in his study (12), and other questions added by the writer. How frequently people use drawing room tools was a secondary consideration.

The method used in working out the larger part of the questionnaire was to make questions to determine how frequently the individual had occasion to read or make the different types of drawings which Hale found in his study (Chapter II, page 16). Because of Hale's detailed analysis there was an overlapping of terms, so that it became necessary to combine certain types of drawing before questions could be framed. For example: wiring diagrams were included with diagrams and charts with graphs. Outdoor drawings were omitted, because it was apparent that they were either pictorial drawings or free-hand sketches. Geometrical constructions and conventions were omitted

because they were also parts of other types of drawing. Furthermore, it was apparent that data indicating how frequently people read certain simple types of drawing would be of little value in working out a course of study in graphic representation; because of their simplicity no training is necessary to read them. Therefore, no questions were asked to determine how often people read picture drawings, mottoes and emblems, lettering, or silhouette drawings. A total of 26 questions were developed from Hale's findings.

These questions were compared with the questions used by Walsh (See Appendix), and it was found that Walsh had five questions which gave uses of graphic representation which were not included in the questions based on Hale's study. These five questions were added to the questionnaire.

None of the questions so far was designed to learn how often the individual uses the common drafting room tools. For this reason three questions were added to see how frequently the scale, T-square and triangles, and the ruling pen were used.

In order to make comparisons as to the extent of use of drawing between those people who had studied drawing and those who had not, each person was asked to indicate if he had had such training.

The final question concerned the occupation or means of livelihood. This information was presented to

show the variety of occupations in which the parents and alumni were engaged.

In its original form the questionnaire consisted of questions on each type of drawing. To answer these questions a check could be made to indicate whether they read drawings or made them. This original set of questions contained terms which laymen do not understand. As an example the first question in the original questionnaire read:

> "Check to what degree you make or read mechanical pictorial drawings such as: isometric, cabinet, oblique, or perspective.

Read Daily Frequently Seldom Never Make Daily Frequently Seldom Never" The terms in this question were found to be too technical, so the question was revised to read:

> "Do you ever make picture drawings in which you use a straight edge or other drawing instruments? (A picture drawing shows the object as it appears to the eye, similar to a photograph) D. F. S. N."

(See Appendix)

The preliminary explanation in the final questionnaire read:

> "In answering these questions will you kindly indicate the degree of use you make of the different types of drawing by encircling the letter which best describes your use: (D)-daily; (F)-frequently; (S)-seldom; (N)never"

In their new form the questions were simplified and limited so that separate questions were used to find out whether individuals read or made each type of drawing. To help the respondents to understand the questions containing technical terms, simple sketches were included. In order to determine the degree to which any of these types of drawing was used a plan, similar to that used by Walsh in his questionnaire, was used. The person answering the questionnaire was asked to indicate the extent to which he used the drawings by checking the letters D. (daily), F. (frequently), S. (seldom), and N. (never).

In order to validate this questionnaire it was used as an outline for interviews with twenty people, and care was taken during the interviews to determine if each of the questions was understood. As already pointed out in the description of the way in which the content and form was worked out, it was found necessary to make some changes in the questions. After these changes were made and tested by additional interviews, the questionnaire was put in its final form. (See Appendix)

A random selection was made from the names of parents of all pupils in the high school. A total of 864 names were available after duplicate names were eliminated. These were placed on cards, and these cards were shuffled. They were then dealt out by placing the first three cards on one pile and the fourth card on a second pile. This dealing was continued until all the cards were divided into two piles. The pile with every fourth card contained the names of 216 parents. Twenty parents out of this group were interviewed, as previously mentioned, and the rest were sent questionnaires made up of the questions used in

the interviews.

Permission was secured from the principal and superintendent of schools to send the questionnaires home through the pupils. This was best done by asking the report room teachers to give out the questionnaires to those pupils whose parents had been selected and to try to have as many returned as possible. Out of 196 questionnaires sent out by this method 103 were returned. These with the 20 interviews made a total of 123 returns.

Questionnaires were sent by mail to all graduates, who could be located, and who had been enrolled in a course in mechanical drawing in the high school during the last eight years. Out of 163 questionnaires sent out 45 were returned.

In order to develop the interview questionnaire to be used with teachers a list of ways in which pupils use drawings was obtained. This list was secured by asking the mechanical drawing pupils to list the various ways in which they use drawing in other school subjects. A copy of the list and the frequency of use of each item may be found on page 89 of the Appendix. Questions were constructed in order to discover from the teachers the extent to which pupils had occasion to use drawing in these different ways. This group of questions was compared with the questionnaire designed for parents and alumni, and wherever it was possible to do so without changing the thought, the questions which were alike were worded in the same way in order that comparisons could be made in the results after the data were collected. A final question used in the teachers' questionnaire was planned in order to find out whether graphic representations are being used in textbooks less, about the same, or more now than they were five or ten years ago.

When the parents' questionnaires were returned they were grouped into three groups: those who had studied drawing, those who had not studied it, and those who did not say. All the questionnaires were numbered consecutively by groups. The data from them were tabulated on master sheets. These were constructed to show horizontally the number of the questionnaire or interview and vertically the number of the question. (See page 90 of the Appendix)

These data were analyzed and the following criteria were applied to them to determine which types of drawing should be included in a proposed course of study: that if 25 percent or more of each of two out of the three groups replied that they used daily or frequently a certain type of drawing and that if in two groups of the three that same type of drawing ranked in the upper twothirds of the answers after they had been arranged according to values then that type should be included. The values assigned each degree of use were three for 'Daily', two: for 'Frequently', one for 'Seldom', and zero for 'Never' or any question not answered.

All of the types of drawing that satisfied the

conditions of the criteria were organized into a course of

study.

Chapter IV RESULTS OR FINDINGS 26

In the presentation of the findings of this study it was necessary to consider several things which might be confusing to readers. Because of the difference in numbers of people included in the three groups interviewed percentages are used in reporting negative and affirmative answers.

Some questions were not used in the teacher questionnaire. However, replies to those questions asked teachers are included with the replies received from the other two groups.

The findings of the study are presented in the order of the questions on the parent-alumni questionnaire, but the number of the question on the teacher questionnaire is also given. Question 1 (No. 2 of the Teachers' Questionnaire)

was:

"Do you ever make picture drawings in which you use a straight edge or other drawing instruments? (A picture drawing shows the object as it appears to the eye, similar to a photograph.)"

The results may be found in Table 1.

Table 1 .-- FREQUENCY OF MAKING PICTURE DRAWINGS MECHANICALLY

Groups Interviewed	Total Cases		Use Made of Drawing									
		Da	ily	Freat	lently	Se	ldom	Nev	ver			
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent			
Parents	116	6	5.2	40	34.5	3 8	3 2.8	32	27.5			
Alumni	44	5	11.4	16	36.3	20	45.5	3	6.8			
Teachers (Pupils' Use)	28	3	10.7	8	28.5	13	46.5	4	14.3			

The replies to this question show that the alumni use and the pupils' use, as indicated by the teachers, were greater than the parents' use for this type of drawing. While there were only 6.8 per cent of the alumni and 14.3 per cent of the teachers that answered 'Never' to this question, there were 27.5 per cent of the parents who answered 'Never'. The percentage of alumni and teachers who gave 'Daily' as an answer to this question were almost the same--11.4 per cent for the former and 10.7 per cent for the latter. In these same two groups there was also a close correlation between the percentages of those answering 'Seldom': 45.5 per cent and

46.5 per cent respectively.

Question 2 (No. 1 of the Teachers' Questionnaire) was:

"Do you ever make a free-hand sketch?" The information secured is presented in Table 2. Table 2.--FREQUENCY OF MAKING PICTURE SKETCHES

Groups	Total	Use Made of Drawing							
	• • • • • •	Da	11v	Fred	lently	Se	ldom	Neve	er
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	118	8	6.8	54	45.7	25	21.2	31	26.3
Alumni	45	4	8.9	20	44.4	16	35.6	5	11.1
Teachers (Pupils' Use)	28	2	7.2	12	42.8	9	32.1	5	17.9

The alumni indicated that they used this type of drawing to a greater extent than the other two groups. Whereas 88.9 per cent of them used it either 'Daily', 'Frequently', or 'Seldom', only 82.1 per cent of the teachers and 73.7 per cent of the parents indicated use made of it to some degree. The daily use indicated in answers to this question was about the same per cent for each source--parents 6.8 per cent, alumni 8.9 per cent and teachers 7.2 per cent. A similar close relationship existed for those answering frequently--the percentages being 45.7 per cent, 44.4, per cent, and 42.8 per cent respectively.

Question 3 was:

"Do you ever make a free-hand picture sketch in which you include dimensions?"

The parents and alumni responses are shown in Table 3.

Table 3.--FREQUENCY OF MAKING FREE-HAND PICTURE SKETCHES WITH DIMENSIONS

Groups Interviewed	Total Cases	Use Made of Drawing								
THOOL 170000	•	Dail	V	Frequ	ently	Seld	om 1	Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	119	9	7.6	49	41.2	30	25.2	31	26.0	
Alumni	45	4	8.9	12	26.7	24	5 3.3	5	11.1	

A little over one-fourth of the parents indicated that they never made free-hand picture sketches in which they included dimensions, while a little more than onetenth of the alumni so indicated. About the same percentage of parents and alumni answered that they used this type of drawing 'Daily'--7.6 per cent and 8.9 per cent respectively. More alumni(24) answered 'Seldom' to this question than they did to any other question. No comparison could be made between the teachers' replies and those of the other groups because this question was not included in the teachers' interview-questionnaire. Question 4 was:

"Do you ever read free-hand picture sketches which include dimensions?"

The data secured in reply are given in Table 4.

Table 4.--FREQUENCY OF READING FREE-HAND PICTURE SKETCHES WITH DIMENSIONS

Groups Interviewed	Total Cases	l Use Made of Drawing								
		Dai	Ly	Freq	uently	Sel	dom	Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num ber	Per Cert	
Parents	120	15	12.5	51	42.5	27	22.5	27	22.5	
Alumni	44	2	4.6	21	47.7	16	36.3	5	11,4	

Although almost three times as many parents as alumni read daily free-hand picture sketches which included dimensions, the results showed that the percentage of parents who never read this type of drawing was almost twice as great as the percentage of alumni. This was offset by the fact that a greater percentage of alumni read these drawings frequently or seldom.

Question 5 (No. 3 of the Teachers' Questionnaire) was:

"Do you ever make a free-hand multi-view or orthographic sketch of objects? In this type of drawing the front, top and side views of the object are drawn separately.

The question was answered as shown in Table 5.

Table 5.--FREQUENCY OF MAKING FREE-HAND ORTHOGRAPHIC SKETCHES

Groups Interviewed	Total Cases	Use Made of Drawing							
		Dail	LVI	Freque	ently	Selo	lom	Nevei	
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	120	6	5.0	4 0	33.3	41	34.2	33	27.5
Alumni	45	4	8.9	17	37.7	13	28.9	11	24.5
Teachers (Pupils' Use)	28	0	0	3	10.7	8	28.5	17	60.8

About one-fourth, 27.5 per cent of the parents and 24.5 per cent of the alumni, replied that they never made free-hand orthographic sketches, while more than onehalf (60.8 per cent) of the teachers said that the pupils never had occasion to make them. Almost the same percentage of all three groups (34.2 per cent, 28.9 per cent, and 28.5 per cent respectively) said that they made this type of drawing seldom. None of the teachers indicated a daily use in answer to this question.

Question 6 (No. 16 of the Teachers' Questionnaire) was:

"Do you ever read free-hand multi-view or orthographic sketches?"

The results follow in Table 6.

Table	6FREQUENCY	OF	READING	FREE-HAND	ORTHOGRAPHIC
			SKET	CHES	

Groups Interviewed	Total Cases	Use Made of Drawing							
		Daily		Frecuently		Seldom		Never	
		Num-	Per	Num-	Per	Num-	Per	Num-	Per
		ber	Cent	ber	Cent	ber	Cent	ber	Cent
Parents	120	10	8.3	43	55.8	32	29.2	35	26.7
Alumni	45	6	13.3	18	40.0	10	22.3	11	24.4
Teachers (Pupils' Use)	28	0	0.0	7	25.0	7	25.0	14	50.0

In answering this question the teachers were equally divided, 14 of them indicating that the student never had occasion to read orthographic sketches, while the other 14 indicated frequent or seldom use of them. The latter 14 were also equally divided seven marking frequently and seven marking seldom. None of the teachers marked daily. Approximately 75 per cent of the parents and alumni read free-hand orthographic sketches to some extent.

Question 7 (Question 4 of the Teachers

Questionnaire) was:

"Do you ever make multi-view or orthographic drawings by using a straight edge or other drawing instruments? Such drawings might include things which you intend to make or have someone make for you."

Table 7 shows the data secured.

Groups Interviewed	Total Cases	Use Made of Drawing								
		Da	ily	Frequently		Seldom		Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	121	7	5.8	46	38.0	33	27.3	35	28.9	
Alumni	45	6	13.3	13	28.9	17	37.8	9	20.0	
Teachers (Pupils' Use)	28	0	0.0	2	7.2	7	25.0	19	67.8	

Table 7.--FREQUENCY OF MAKING MECHANICAL ORTHOGRAPHIC DRAWINGS

Parents and alumni made orthographic drawing by the use of instruments more frequently than pupils did in their school work. Only one-third of the teachers (32.2 per cent) indicated that the pupils used this type of drawing while 80 per cent of the alumni and 71.1 per cent of the parents indicated some use. The sum of the percentages of parents that used this kind of drawing frequently and seldom was practically the same as that of the alumni: 65.3 per cent and 66.7 per cent.

Question 8 was:

"Do you ever read multi-view drawings which have been made with instruments? Many such drawings which occur in magazines show how to make pieces of furniture, cabinets, and various appliances."

The parents' and alumni answers are presented in Table 8.

Table 8.--FREQUENCY OF READING MECHANICAL MULTI-VIEW DRAWINGS

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	Daily Frequently Seldom				lom	Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	122	18	14.7	53	43.5	27	22.1	24	19.7	
Alumni	44	8	18.2	22	50.0	6	13.6	8	18.3	

There was a very close relationship between the answers of parents and alumni for each of the four degrees of use. The greatest variation was about 7 per cent, and this occurred both in 'Frequently' and 'Seldom'. In the former, the alumni percentage was greater while in the latter the parent percentage was greater. About one-half of the parents (43.5 per cent) and alumni (50.0 per cent) said they read multi-view drawings frequently. Over four-fifths of both groups answered that they read this type of drawing to some degree.

Question 9 was:

"Do you ever use a drawing for the purpose of assembling an article or machine?"

The results may be found in Table 9.
Table 9.--FREQUENCY OF READING DRAWINGS FOR ASSEMBLING

Groups Interviewed	Total Use Made of Drawing										
		Dai	Daily Frequently Seldom Never								
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	120	23	19.4	44	36.5	26	21.6	27	22.5		
Alumni	45	9	20.0	18	40.0	ll	24.4	7	15.6		

An even closer correlation existed between the replies of the parents and alumni for each degree of use than existed in the preceding table. Again the greatest variation was 7 per cent, but this occurred only in one place, namely, in those checking 'Never'. Of the parents 22.5 per cent said they never used drawings for assembling articles or machines while of the alumni 15.6 per cent answered in this way.

Question 10 (No. 5 of the Teachers Questionnaire)

was:

"Do you ever make drawings in which there are sectional views (portions cut away to enable one to see the interior construction or to aid with assembling)?"

The answers are given in Table 10.

in a

Table 10.--FREQUENCY OF MAKING SECTIONAL VIEWS

Groups Interviewed	Total Cases	Use Lade of Drawing								
		Dai	ly I	Frecu	ently	Selo	lon	Neve:	I,	
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	122	9	7.4	34	27.9	26 ·	21.3	53	43.4	
Alumni	45	5	11.1	14	31.1	12	26.7	14	31.1	
Teachers (Pupils' Use)	28	0	0.0	2	7.2	7	25.0	19	67.8	

A greater percentage of parents and alumni than teachers (pupils use) indicated that they made drawings with sectional views. The alumni in 68.9 per cent of the cases made this type of drawing most frequently as shown by the table, while the parents made them in 56.6 per cent of the cases and the teachers in only 32.2 per cent of the cases. More people checked 'Never' in their answers than any other degree of use, and in the case of parents and alumni more people checked 'Frequently' than they did 'Seldom'.

Question 11 was:

"Do you ever read drawings containing sectional views?"

The results are presented in Table 11.

دينية. نورية تعد Table 11.--FREQUENCY OF READING SECTIONAL VIEWS

Groups Interviewed	Total Cases		Use Made of Drawing									
		Dai	Daily Frequently Seldom Never									
		Num- ber	Num-Per Num-Per Num-Per Num-Per Der Cent ber Cent ber Cent ber Cent									
Parents	122	25	20.5	36	29.5	33	27.0	28	23.0			
Alumni	45	5	11.1	16	35.6	15	33.3	9	20.0			

The percentage of parents who indicated their degree of use as 'daily' for this question was almost twice as great as the percentage of alumni who checked it the same way: 20.5 per cent as compared to ll.1 per cent. The daily use was checked by more parents for this question than for any question in the questionnaire. The answers of the parents to the other three degrees of use were closely related to those of the alumni. The greatest degree of difference was 6.1 per cent in the case of 'Frequently', in which the percentage of parents was 29.5 per cent and the alumni 35.6 per cent.

Question 12 was:

"Do you ever make any mottoes or emblems such as are used in advertising, trade-marks, designs, stamps, medals, insignia, and the like?"

The information secured is presented in Table 12.

Table 12.--FREQUENCY OF MAKING MOTTOES AND ELELEMS

Groups Interviewed	Total Cases	Use Made of Drawing										
		Dai	Daily Frequently Seldom Never									
		Num-	Per	Num-	Per	Num-	Per	Num-	Per			
		ber	Cent	ber	Cent	ber	Cent	ber	Cent			
Parents	118	3	2.5	9	7.6	31	26.3	75	63.6			
Alumni	44	3	6.8	5	11.3	13	29.5	23	52.4			

This table showed that more than half of the two groups never made mottoes, emblems, etc. The percentage of those who indicated that they use this type of drawing daily was almost three times as great among the alumni as among the parents.

Question 13 (Question 9 of the Teachers' Questionnaire) was:

"Do you ever do any lettering (place cards, filling out blanks, etc)?"

The results may be found in Table 13.

Table 13.--FREQUENCY OF USING LETTERING

Groups Interviewed	Total Cases			Use Made of Drawing						
		De	ily	Frea	uently	Seldom		Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	122	12	9.8	28	23.1	36	29.4	46	37.7	
Alumni	45	13	28.9	20	44.4	9	20.0	3	6.7	
Teachers (Pupils' Use)	28	2	7.2	15	53.5	7	25.0	4	14.3	

A greater percentage of alumni (93.3 per cent) than parents (62.3 per cent) or teachers (85.7 per cent) make some use of lettering. The smaller percentage of use is indicated by the parents. In all the cases the percentage of use is high as compared to the other questions. More alumni checked 'Daily' for the answer to this question than they did for the answer to any other question. In like manner more teachers marked 'Frequently' for the answer to this question then they did for the answer of any other question.

Question 14 was:

"Do you ever make any posters on which lettering is required?"

The parent and alumni answers are presented in Table 14. Table 14.--FREQUENCY OF MAKING POSTERS USING LETTERING

Groups Interviewed	d Cases										
		Daily Frequently Seldom Never									
		Num ber	Per Cent	Num ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	118	3	2.5	10	8.5	32	27.0	73	6 2.0		
Alumni	45	2	4.4	9	20.0	15	33.3	19	42.3		

Although this table shows that alumni made posters with lettering more than parents did, in both cases the percentage of those that said they never used it was very high--62.0 per cent for parents and 42.3 per cent for alumni. Question 15 (Number 6 of the Teachers'

Questionnaire) was:

"Do you ever make any diagrams for the purpose of showing the relation of one object to another or to show the relation between parts?"

The results may be found in Table 15.

Table 15.--FREQUENCY OF MAKING DIAGRAMS FOR THE PURPOSE OF SHOWING THE RELATION OF ONE OBJECT TO ANOTHER

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	lly	Fred	uently	S	eldom	Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	122	4	3.3	36	39.5	4 0	32.8	42	34.4	
Alumni	44	4	9.1	14	31.8	14	31.8	12	27.3	
Teachers (Pupils Use)	28	0	0.0	6	21.5	6	21.5	16	57.0	

The number of alumni who answered 'Frequently' and 'Seldom' is the same--14. The number of parents answering 'Frequently', 'Seldom', and 'Never' is about the same--36, 40, and 42. Teachers rated the making of diagrams low as shown by the fact that no one answered 'Daily' and 16, or 57 per cent, answered 'Never'. The per cent of alumni who answered 'daily' is about three times as great as the per cent of parents.

Question 16 (Number 17 of the Teachers' Questionnaire) was:

> "Do you ever read diagrams such as those used to explain the parts of the automobile and the oiling and greasing system?"

The answers are found in Table 16.

Table 16.--FREQUENCY OF READING DIAGRAMS

Groups Interviewed	Total Cases			Use Made of Drawing					
		De	ily	Freq	uently	Seldom		Never	
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	122	17	13.5	59	48.4	26	21.3	20	16.8
Alumni	45	10	22.2	18	40.0	12	26.7	5	11.1
Teachers (Pupils' Use)	28	4	14.3	7	25.0	11	39.2	6	21.5

The number of respondents who indicated that they had some use for reading diagrams is much greater than the number of those who said they made diagrams. This is evidenced when Tables 15 and 16 are compared. Also in both tables it can be noted that alumni both read and make diagrams more than parents, and that teachers in both cases make use of them less, as indicated by their 'Never' answers. On the other hend, more teachers did indicate a 'Daily' use in answer to this question than they did for any other question.

Question 17 (Number 7 of the Teachers' Questionnaire) was:

> "Do you ever make any charts or graphs such as organization charts, flow sheets, bar charts, line or curve graphs, pie charts, pictograms, etc.?"

The information secured is presented in Table 17.

Table 17 .- - FREQUENCY OF MAKING CHARTS OR GRAPHS

Groups Interviewed	Total Cases	Use Made of Drawing								
		De	ily	Freg	uently	Se]	dom	Neve:	r	
		Num- be r	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	121	4	3.2	21	17.4	32	26.4	64	53.0	
Alumni	45	5	11.1	13	28.9	12	26.7	15	33.3	
Teachers (Pupils [,] Use)	29	1	3.6	12	42.8	9	32.2	6	21.4	

Although more than half of the parents, 53 per cent, indicated that they never made any charts or graphs, more than two-thirds, 66.7 per cent, of the alumni and about four-fifths, 79.6 per cent, of the teachers did make some use of them. The percentage of parents that answered 'Daily' to this question is about the same as that of the teachers while more than three times as large a percentage of alumni answered 'daily'. The percentage of parents and alumni that answered 'Seldom' is practically the same--26.4 per cent and 26.7 per cent respectively.

Question 18 (Number 18 of the Teachers' Questionnaire) was:

> "Do you ever read charts or graphs such as appear in the newspapers, magazines, and other literature?"

The results may be found in Table 18.

Table 18.--FREQUENCY OF READING CHARTS OR GRAPHS

Groups Interviewed	Total Cases	Use Made of Drawing									
		Dei:	Daily Frequently Seldom Never								
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	121	14	11.6	59	48.7	31	25.6	17	14.1		
Alumni	44	6	13.6	24	54.5	10	22.7	4	9.2		
Teachers (Pupils' Use)	28	2	7.2	13	46.4	5	17.9	8	28.5		

In all three groups the number who answered 'Frequently' is greater than the number who answered for any other degree of use--about one-half of the total replies for each group. About one-fourth of the parents and alumni read charts and graphs seldom. About twice as many pupils (as stated by teachers) as parents never read charts and graphs, and about three times as many pupils as alumni never read them.

Question 19 was:

"Do you ever make any silhouette drawings?" The answers are presented in Table 19. Table 19.--FREQUENCY OF MAKING SILHOUETTE DRAWINGS

Groups Interviewed	Total Cases										
		Daily Frequently Seldom Never									
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	118	l	0.9	5	4.1	20	17.0	92	78.0		
Alumni	43	0	0,0	1	2.3	11	25.6	31	72.1		

This table shows that very few people ever make silhouette drawings. More than 95 per cent indicate only a 'Seldom' or 'Never' use. Only one person--an artist-denoted a daily use of this kind of drawing.

Question 20 (Number 10 of the Teachers' Questionnaire) was:

"Do you ever make any maps?" The data secured may be found in Table 20. Table 20.--FREQUENCY OF MAKING MAPS

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	ly [Frequ	ently	Sel	dom	Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	119	3	2.5	16	13.5	39	32.7	61	51.3	
Alumni	44	l	2.3	5	11.4	16	36.3	22	50.0	
Teachers (Pupils' Use)	28	0	0.0	7	25.0	9	32.2	12	42.8	
Abo	out on	e-hal:	f of	the p	arents	and	alumn	i neve	er	

make any maps; while one-third of all groups indicate only a 'Seldom' use. One alumnus and three parents make maps daily.

Question 21 (Number 19 of the Teachers' Questionnaire) was:

"Do you ever read any maps?" The answers may be found in Table 21. Table 21.--FREQUENCY OF READING MAPS

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	ly F	requ	ently	Sel	dom	Neve:	r	
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	120	13	10.8	72	60.0	27	22.5	8	6.7	
Alumni	45	5	11.1	20	44.4	17	37.8	3	6.7	
Teachers (Pupils' Use)	28	l	3.6	10	35.6	9	32.2	8	28.6	

Whereas only four people made maps daily (See Table 20) nineteen people read them daily. Fewer parents and alumni answered 'Never' to this question than they did to any other question. More parents (72) marked 'Frequently' in answering this question than they did in answering any other question.

Question 22 (Number 11 of the Teachers' Questionnaire) was:

"Do you ever make any floor plans for houses or buildings?"

The results may be found in Table 22.

Table 22 .-- FREQUENCY OF MAKING FLOOR PLANS

Groups Interviewed	Total Cases	Use Made of Drawing							
		Dai	lv	Frequ	ently	Sel	lom	Neve:	r
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	118	4	3.4	27	22.9	40	33.9	47	39.8
Alumni	45	0	0.0	8	17.8	10	22.2	27	60.0
Teachers (Pupils' Use)	28	0	0.0	2	7.2	9	32.2	17	60.6

No alumni or teachers marked a 'Daily' use for making floor plans for houses or building. On the contrary 60 per cent of both groups indicated that they never used this type of drawing. In each degree of use the parents make floor plans more often than the alumni or teachers. This indicates that, although the pupil will not have an immediate use for this type of drawing, there is a predictable future use, as shown by the fact that more than 60 per cent of the parents make floor plans.

Question 23 (Number 20 of the Teachers' Questionnaire) was:

> "Do you ever read any floor plans for houses or buildings either in blue print form or as they appear in the magazines?"

The information secured may be found in Table 23.

Table 23.--FREQUENCY OF READING FLOOR PLANS

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	ly I	reau	ently	Sel	dom	Neve	r	
	•	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	120	13	10.8	48	40.0	42	35.0	17	14.2	
Alumni	45	1	2.2	19	42.2	19	42.2	6	13.4	
Teachers (Pupils' Use)	28	0	0.0	З	10.7	12	42.8	13	46.5	

The table when compared to Table 22 page 47 reveals that more people read floor plans than make them. The percentage of parents and alumni that read floor plans to some extent is practically the same--85.3 per cent and 86.6 per cent respectively. No teachers indicated that pupils read this type of drawing daily. Also only five out of the twenty-eight teachers indicate any use for this type of drawing.

Question 24 (Number 12 of the Teachers' Questionnaire) was:

"Do you ever make elevations for houses or buildings?"

The answers are presented in Table 24.

Table 24.--FREQUENCY OF MAKING ELEVATIONS Total Use Made of Drawing Groups Interviewed Cases Frequently Daily Seldom Never Num-Num- Per Num-Per Per Num-Per Cent ber Cent ber ber Cent ber Cent Parents 118 24 18 1 0.9 20.3 15.3 75 63.5 Alumni 45 0 0.0 2 4.4 8 17.8 35 77.8 Teachers

1

3.6

4

14.3 23

None of the alumni or teachers (pupil use) and only one parent indicated that they ever made elevations for houses or buildings, while about three-fourths of these groups revealed that they never made this type of drawing. Parents indicate a greater use to some extent than alumni, and alumni show a greater use than teachers.

Question 25 (Number 21 of the Teachers' Questionnaire) was:

0.0

0

"Do you ever read elevations for houses or buildings?"

The results follow in Table 25.

28

(Pupils'

Use)

45

82.1

Table 25.--FREQUENCY OF READING ELEVATIONS

	And in case of the local division of the loc					the second se	the second s	the second s	
Groups Interviewed	Total Cases	Use Made of Drawing							
		Dai	ly I	reque	ently	Seld	om	Never	······································
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	120	5	4.2	37	30.8	31	25.8	47	39.2
Alumni	45	0	0.0	6	13.4	21	46.6	18	40.0
Teachers (Pupils' Use)	28	0	0.0	2	7.2	8	28.6	18	64.2

Again we find by comparison of this table with Table 24 page 49 that there is a greater use for reading of certain types of drawing than for making them. Whereas in Table 24, page 49,133 people said that they never made these drawings, in Table 25 only 83 people said they never read these drawings. None of the teachers or alumni indicated a 'Daily' use for this reading of elevations of houses or buildings although five parents did so mark. The per cent of teachers who stated that pupils read this type of drawing to some extent is smaller than the per cent of parents or alumni.

Question 26 was:

"Do you ever make any picture sketches or drawings of a house or building?"

Table 26 shows the data secured.

Table 26.--FREQUENCY OF MAKING PICTURE SKETCHES OF HOUSES

Groups Interviewed	Total Cases	Use Made of Drawing										
		Dai	Daily Frequently Seldom Never									
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent			
Parents	119	3	2.5	23	19.3	50	42.0	43	36.2			
Alumni	45	0	0.0	5	11.2	20	44.4	20	44.4			

Almost 60 per cent of the parents and alumni indicate that they make to some extent drawings or sketches of houses or buildings. None of the alumni and only three of the parents report that they make daily this type of drawing. More parents and alumni indicate a 'Seldom' use than they do a 'Frequent' or 'Daily' use for this type of drawing.

Question 27 was:

"Do you ever make any picture sketches or drawings of a house or building?"

The parents' and alumni replies are presented in Table 27.

Table 27.--FREQUENCY OF MAKING SKETCHES BEFORE REMODELLING ANY PART OF A HOME

Groups Interviewed	Total Cases	l Use Made of Drawing										
		Dai	Daily Frequently Seldom Never									
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent			
Parents	119	1	0.8	29	24.4	46	38.7	43	36.1			
Alumni	45	0	0.0	5	11.1	10	22.2	30	66.7			

About twice as great a percentage of parents as alumni revealed that they make sketches or drawings previous to remodelling. Only one parent does this daily.

Question 28 (Number 13 of the Teachers!

Questionnaire) was:

"Do you ever make patterns or cut-outs of objects which are made out of thin material - paper, card-board, or sheet metal?"

The results may be found in Table 28.

Table 28.--FREQUENCY OF MAKING PATTERNS OR CUT-OUTS OF OBJECTS

Groups Interviewed	Total Cases	Use Made of Drawing								
		Dai	ly I	Freque	ently	Sel	lom	Neve:	r	
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	
Parents	119	3	2.5	26	21.8	38	32.0	52	43.7	
Alumni	45	1	2.3	11	24.4	14	31.1	19	42.2	
Teachers (Pupils' Use)	28	0	0.0	2	7.2	4	14.3	22	78.5	

The percentage of parents and alumni who never make developments is practically the same, 43.7 per cent and 42.2 per cent, while the percentage of teachers who indicate 'Never' is almost twice as great--78.5 per cent. The percentage of parents and alumni for each degree of use run almost parallel: 2.5 per cent and 2.3 per cent for 'Daily'; 21.8 per cent and 24.4 per cent for 'Frequently'; and 32.0 per cent and 31.1 per cent for 'Seldom'.

Question 29 was:

"Do you ever use patterns, cut-outs, or sheet metal drawings?"

The parents' and alumni answers are presented in Table 29. Table 29.--FREQUENCY OF USING PATTERNS

Groups Interviewed	red Cases								
		Dai	ly	Frequ	ently	Sel	dom	Neve	r
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	118	5	4.2	25	21.2	45	38.2	43	36.4
Alumna	40.	2	4.4	12	26.7	13	28.9	18	40.0

The number of parents who never use patterns and those who use them seldom is about the same--43 per cent and 45 per cent respectively. The percentage of the parents and alumni who use daily this type of drawing is about the same--4.2 per cent and 4.4 per cent. Also the percentages of these two groups which answered 'Never'

is about the same--36.4 per cent and 40.0 per cent.

Question 30 was:

"Did you ever have occasion to make or read a patent office drawing?"

The information secured may be found in Table 30.

Table 30.--FREQUENCY OF MAKING OR READING A PATENT OFFICE DRAWING

Groups Interviewed	Total Cases	Use Made of Drawing										
		Dei	Daily Frequently Seldom Never									
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent			
Parents	118	0	0.0	13	11.0	27	22.9	78	66.1			
Alumni	45	l	2.3	7	15.6	11	24.4	26	57.7			

The percentages of the parents who answer to each of the different degrees of use 'Daily', 'Frequently', 'Seldom', and 'Never' is about the same as the percentages of alumni answering to the same degree of use. One alumnus indicated that he read patent office drawings daily, while no parents answered in this way. A greater per cent of alumni than parents found some use for this type of drawing. Almost one-fourth of both groups indicated that they used this type of drawing seldom.

Question 31 was:

"Have you ever had an idea which you considered patentable but felt that you were unable to draw it properly to obtain a patent?"

The results are shown in Table 31.

Table 31.--FREQUENCY OF NEED TO MAKE A PATENT OFFICE DRAWING

Groups Interviewed	Total Cases		Use Made of Drawing								
		Dail	V F	requei	ntly	Seld	lom	Neve:	r		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	116	1	0.9	7	6.1	18	15.5	90	77.5		
Alumni	45	0	0.0	4	8.9	4	8.9	37	82.2		

More parents and alumni answered 'Never' to this question than they did to any of the other questions. No alumni and only one parent indicated that they used this daily.

Question 32 was:

"Do you ever use the scale (an instrument used for measuring in drawing) for making drawings to different scales?"

The data are presented in Table 32.

Table 32.--FREQUENCY OF USING A DRAWING SCALE

Groups Interviewed	Total Cases		Use Made of Drawing								
		Dai	ly	Frequ	ently	Sel	dom	Neve	r		
	•	Num- ber	Per Cent	Num- ber	Per Cenu	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	119	18	15.1	24	20.2	33	27.7	44	37.0		
Alumni	45	6	13.4	14	31.1	11	24.4	14	31.1		

ő:

About two-thirds of both parents and alumni reported that they used the drawing scale to some extent. Almost the same percentage of parents and alumni indicated that they use the scale daily.

Question 33 (Number 14 of the Teachers' Questionnaire) was:

> "Do you ever use the T-square or triangles in ruling lines for making office forms, borders, etc.?"

The results may be found in Table 33.

Table 33.--FREQUENCY OF USE OF THE T-SQUARE AND TRIANGLES

Groups Interviewed	Total Cases	l Use Made of Drawing									
	-	Dail	Daily Frequently Seldo						Never		
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent		
Parents	121	12	9.9	31	25.6	35	27.3	45	37.2		
Alumni	45	7	15.5	18	40.0	6	13.4	14	31.1		
Teachers (Pupils' Use)	28	1	3.6	2	7.2	7	25.0	18	64.2		

Although about two-thirds of the parents and alumni indicate that they use the T-square and triangles to some degree, only about one-third of the pupils have a use for it as indicated by the teachers. A greater percentage of alumni than parents or teachers reported a daily use of T-square and triangles.

Question 34 (Number 15 of the Teachers' Questionnaire) was: ÖŨ

"Do you ever use the ruling or inking pen for meking ink lines?"

The data secured may be found in Table 34.

Teble 34 .-- FREQUENCY OF USING THE RULING PEN

Groups Interviewed	Total Cases		τ	Jse M	ede of	Draw	ing		
11100101000		Dai	lv I	recu	ently	Seld	lom	Neve:	r
		Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent	Num- ber	Per Cent
Parents	119	7	5.9	22	18.5	40	33.6	50	42.0
Alumni	45	6	13.3	15	33.3	12	26.7	12	26.7
Teachers (Pupils' Use)	28	1	3.6	2	7.2	2	7.2	23	82.0

A greater percentage of alumni than parents use the ruling pen to some extent, while the percentage of the parents that use it is about four times as great as the percentage of pupils, according to the teachers' replies, that use it.

In addition to the 34 questions asked parents and alumni, the teachers were asked question 8 of Teachers' Questionnaire whether pupils ever made notebook covers in which lines or designs are drawn. Of the 28 teachers, one answered 'Daily', 12, 'Frequently', seven 'Seldom', and eight 'Never'. The percentage of teachers' answers was 3.6 per cent, 42.8 per cent, 25.0 per cent, and 28.6 per cent respectively.

The final question in the Teachers'

Questionnaire asked: "Do you find (fewer), (About the same), (more) diagrams, charts, graphs, and line drawings in the text-books used today than in those used five or ten years ago?" (See Appendix) results revealed that 25 teachers stated that in text-books with which they were familiar more diagrams, charts, graphs, and line graphs are found today; two teachers stated the number was about the same; and one stated there were fewer.

In reply to the supplementary question: "Have you studied drawing?" 58 parents indicated that they had and 59 indicated that they had not. Table 35 page 59 shows a comparison of their answers to the 34 questions. Since the number of parents in both groups is not the same, for purposes of comparison only percentages were " given. In every question the per cent of parents who answered 'Daily' was greater for those who had indicated that they had studied drawing than for those who had not. In questions 16 and 21 the per cent of parents who answered 'Frequently' was greater for those who had not studied drawing than for those who had. In all other questions marked 'Frequently' the opposite is true. Among those parents who had not studied drawing there was a greater per cent who answered the questions 'Never' than there was among those parents who had studied drawing. The foregoing analysis of this table reveals that those people who had studied drawing make use of it

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Table 35.--COMPARISON OF REPLIES OF THOSE PARENTS WHO HAD STUDIED DRAWING WITH THOSE WHO HAD NOT in their daily activities much more than do those who have not studied drawing.

Since questionnaires were sent only to alumni who had studied drawing their answers all fell into one group.

The various occupations in which the parents and alumni were engaged, as revealed by their answers in the space given for that purpose at the end of the questionnaire, have been listed in Chapter III, pages 18 and 19.

An analysis and interpretation of the foregoing findings will be presented in the following chapter.

Chapter V ANALYSIS OF DATA

The first step in the analysis of the data presented in the previous chapter is to see how many types of drawing, as revealed by the questions, were used daily or frequently by 25 per cent or more of the parents, alumni, and pupils (teachers' answers). Table 36 on the following page gives in a condensed and combined form the percentages of each of the three groups which indicate a daily and frequent use for the drawings referred to by the 34 questions. This table reveals that ten out of the 34 questions were answered by 'Daily' or 'Frequently' by less than 25 per cent of the parents. It further shows that the same number of questions out of the whole list was marked 'Daily' and 'Frequently' by less than 25 per cent of the alumni. Although there were ten cuestions in each group which ranked low in use only seven of these ranked low in both groups. This table further shows that the replies to 11 out of the 20 teachers' questions-which correspond to the parent-alumni questionnaire-indicated a daily or frequent use by less than 25 per cent of the pupils.

The first step of the analysis is completed by applying the first criterion as set up in Chapter III,

Table 36.--PERCENTAGE OF PARENTS, ALUMNI, AND TEACHERS WHO USE DRAWING DAILY AND FREQUENTLY

Number	Pe	rcentages	· · · · · · · · · · · · · · · · · · ·
	Parents	Alumni	Teachers
1. 2. 3.	39.7 52.5 48.8	47.7 53.3 35.6	39.2 50.0
4. 5. 6. 7.	55.0 38.3 44.1 43.8	52.3 46.4 53.3 42.2	10.7 25.0 7.2
8. 9. 10. 11.	58.2 65.9 35.3 50.0	68.2 60.0 42.2 46.7	7.2
12. 13.	10.1 32.9	18.1 73.3	60.7
14. 15. 16. 17. 18.	32.8 61.9 20.6 60.3	24.4 40.9 62.2 40.0 68.1	21.5 39.3 46.4 53.6
19. 20. 21. 22.	5.0 16.0 70.8 26.3	2.3 13.7 55.5 17.8	25.0 39.2 7.2
23. 24. 25. 26.	21.2 35.0 21.8	44.2 4.4 13.4 11.2	3.6 7.2
27. 28. 29. 30.	25.2 24.3 25.4 11.0	11.1 26.7 31.1 17.9	7.2
31. 32. 33. 34.	7.0 35.3 35.5 24.4	8.9 44.5 55.5 46.6	10.8 10.8

page 25. Table 37 page 64 shows which questions were answered by 'Daily' or 'Frequently' by 25 per cent or more of each of the three groups--parents, alumni, and teachers. This reveals that all but 15 types of drawing-indicated by questions--are used by 25 per cent or more of each of two out of the three groups. The ll types of drawing which should be excluded from the course on this basis are:

1. Making mottoes or emblems Making posters with lettering 2. 3. Making silhouette drawings 4. Making maps Making floor plans for houses 5. Making elevations for houses 6. Reading elevations for houses 7. Meking picture sketches of houses 8. Making picture sketches for remodelling houses 9. 10. Making developments Reading patent office drawings 11. Making patent office drawings 12. 13. Using the ruling pen

It further reveals that seven types of drawing-making mechanical picture drawings, making free-hand picture sketches, reading free-hand orthographic sketches, doing lettering, reading diagrams, reading charts and graphs, and reading maps--are used daily or frequently by 25 per cent of the people in all three groups, while 14 types are used daily or frequently by 25 per cent or more of two out of the three groups.

The second step of the analysis was to rank the types of drawing, about which the questions inquire, on a basis which combines all three degrees of use for the purpose of discovering which ones rank in the upper

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Question Number	Us]	Used Daily or Frequently By 25 Per Cent or More				
	Parents	Alumni	Teachers			
1.	X	X	X			
2.	X I	X	A 0			
4.	X	X	Õ			
5.	X	X	T			
7.	X	X	A •			
8.	X	X	0			
10	X	X	0			
11.	x	x	Ō			
12.	••• •• ••	-	0			
13.	x -	X -	X O			
15.	X	X	-			
16.	X	X	X			
18.	T T	X	X			
19.			0			
20.	- x	Ā	X X			
22.	X	-	an a			
23.	X _	X				
25.	X	-	n de la constante de la constan En la constante de la constante			
26.	-		0			
28.	-	x	-			
29.	X	X	0			
30. 31	_		0			
32.	x	X	Ŏ			
33.	X	, X	-			
34.	-	•	-			

two-thirds of the groups.

The values assigned the various degrees of use were three for Daily, two for Frequently, and one for Seldom. Upon this basis the replies of the parents are ranked in Table 38, page 67. The question dealing with map reading ranked the highest with a value of 210, while the question about making silhouette drawings ranked last with a value of 33.

The replies of the alumni were ranked by the same method as was used in ranking the parents. Table 39, page 67, shows how they rank in total value. The question which asked the use for doing lettering ranked highest with a total value of 88, while a value of 12 placed the questions on making elevations for houses and the need for making patent office drawings at the bottom of the list.

The teachers' replies to the 21 questions which they answered are ranked in Table 40, page 68. Both the number of the original teachers' question and the corresponding number of the parent-alumni questionnaire are presented, the latter in parenthesis. This latter number will be the one referred to in future analysis for the sake of clearness. The question dealing with doing lettering ranked highest with a value of 45, while the question dealing with making elevations ranked lowest with a value of six.

A comparison of the ranking of the questions

Table 38 .-- PARENTS' REPLIES RANKED ACCORDING TO VALUES OF ONE FOR SELDOM; TWO FOR FREQUENTLY; AND THREE FOR DAILY Rank Question Value Rank Question Value 1. 18. 2. 19. 3. 20. 4. 21. 5. 22. 23. 6. 7. 24. 8. 25. 9. 26. 27. 10. 11. 28. 12. 29. 13. 30. 31. 14. 15. 32. 33. 16. 34. 17. Table 39 .- ALUMNI REPLIES RANKED ACCORDING TO VALUES OF ONE FOR SELDOM; TWO DOR FREQUENTLY; AND THREE FOR DAILY Question Rank Question Value Rank Value 1. 18. 2. 19. 3. 20. 4. 21. 5. 22. 6. 23. 7. 24. 8. 25. 9. 26. 10. 27. 11. 29. 12. 29. 13. 30. 14. 31. 15. 32. 16. 33. 17. 34.

1. 9 (13) 43 2. 1 (2) 39 3. 2 (1) 38 4. 17 (16) 37 5. 18 (18) 37 6. 7 (17) 36 7. 8 34 8. 19 (21) 32 9. 10 (20) 23 10. 16 (6) 21 11. 20 (23) 18 12. 6 (15) 18 13. 14 (33) 18 14. 3 (5) 14 15. 11 (22) 13 16. 21 (25) 12 17. 4 (7) 11 18. 5 (10) 11 19. 15 (34) 9 20. 13 (28) 8 21. 12 (24) 6	Rank	Question	Value	
Number in Parenthesis Is the Corresponding Number of the Parent-Alumni Questionnaire	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21.	$\begin{array}{c} 9 (13) \\ 1 (2) \\ 2 (1) \\ 17 (16) \\ 18 (18) \\ 7 (17) \\ 8 \\ 19 (21) \\ 10 (20) \\ 16 (6) \\ 20 (23) \\ 6 (15) \\ 14 (33) \\ 3 (5) \\ 11 (22) \\ 21 (25) \\ 4 (7) \\ 5 (10) \\ 15 (34) \\ 13 (28) \\ 12 (24) \end{array}$	43 39 38 37 37 36 34 32 23 21 18 18 18 18 18 18 18 18 14 13 12 11 11 11 9 8 6	
	Number in Pa of	arenthesis Is the the Parent-Alumni	e Corresponding Num Questionnaire	lber

by the three groups (See Tables 38, 39, 40, pages 67 and 68 reveals that in each arrangement the value assigned the question ranking first is seven times as great as the value assigned the question or questions ranking last--210 to 35 for parents, 88 to 12 for alumni, and 43 to 6 for teachers. The number values in the three groups do not correspond because each group was made up of a different number of individuals--123 parents, 45 alumni, and 28 teachers. In both the alumni and teacher groups the same type of drawing, lettering, ranked highest and the same type, drawing elevations, ranked lowest.

The final analysis in the second step was to apply the second criterion, as given in Chapter III, page 25. This states that a type of drawing must rank in the upper two-thirds in two out of the three groups before it should be included in the proposed course of study. Table 41, page 70, reveals which types of drawing rank in the upper two-thirds of each of the three groups of parents, alumni, and teachers. This table is based on the data presented in Tables 38, 39, and 40, pages 67, and 68, and it shows that 11 types of drawing rank in the upper two-thirds in all three groups, while 10 types rank in the upper two-thirds in two out of the three groups. It further shows that the following 13 types of drawing fail to rank in the upper two-thirds in two out of the three groups:

Question Number	Ranked	in Upper	Two-Thirds	
	Parents	Alumni	Teachers	
1.	X	X	x	
2.	X	X	X	
3.	X	X	0	
4.	X V	X	0	
5. 6	A V	Å V	A Y	
0. 7	X	A Y	A	
8.	x	X	0	
9.	X	x	õ	
10.	X	x	-	
11.	X	x	0	
12.	-	-	0	
13.	X	X	X	
14.	-	-	U V	
10.	A V	X V	X Y	
17	~ ~	x	X	
18.	x	x	x	
19.	-	-	0	
20.	-	-	X	
21.	X	X	X	
22.	-		- -	
20.	A	A	~	
25 25	- x	-	-	
26.	-	-	0	
27.	X	-	0	
28.	-	-		
29.	X	X	0	
30.	-	-	0	
31.	-	-	0	
32。 77	A V	A V	v	
30. 34	л -	$\hat{\mathbf{x}}$	~	
	unter de la grande de la companya d			
$\mathbf{X} = \mathbf{Mee}$	ts Requiren	nent 0:	No Correspon	din
	redarren	10110	muner.	

Table 41.--REPLIES OF QUESTIONS WHICH RANKED IN THE UPPER TWO-THIRDS AFTER VALUES WERE ASSIGNED

Making mottoes or emblems 1. Making posters with lettering 2. Making silhouette drawings 3. 4. Making maps Making floor plans for houses 5. Making elevations for houses 6. Reading elevations for houses 7. Making picture sketches of houses 8. Making picture sketches for remodelling houses 9. Making developments 10. Reading patent office drawings 11. Making patent office drawings Using the ruling pen 12.

13.

A third major step in the analysis of the data revealed from the replies to the 34 questions, combines the results found by separate application of the two criteria to discover which types of drawing meet both of these and thereby should be included in the course of study. Such an analysis reveals that the same 13 types of drawing which failed to meet the first criterion also failed to meet the second criterion. Therefore, these types of drawing, as listed on page 65 and page 71 of this chapter, should not be included in the course.

A reference to the findings, as presented in Chapter IV, shows that each of the types of drawings which has been discarded is used very little by any of the three groups from whom the data were secured. Table 12, page 39, shows that more than one half of the people who answered never made mottoes or emblems. The percentage of people who said that they never make posters with lettering is very high as shown by Table 14, page 40. Table 19, page 45, reveals that very few people ever make silhouette drawings. The replies to Question

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20, shown in Table 20, page 45, revealed that about onehalf of the parents and alumni never make maps. Floor plans for houses were made by 60 per cent of the parents but only by 40 per cent of the alumni and pupils, as revealed by the data in Table 22, page 47. Table 24, page 49, shows that about three-fourths of the people in each group never make elevations of houses. Although more people read elevations than make them, the percentage of those who read them frequently or daily is very low, as revealed by Table 25, page 50. References to Tables 26, 27, 28, 30, 31, and 34, pages 51, 52, 54, 55, 57 show that making sketches of houses, making sketches for the purpose of remodeling, making developments, patterns, reading patent office drawings, making patent office drawings, and using the ruling pen has no place in the daily life of many of the people from whom the information was secured.

An analysis of the 34 questions on the basis of the kind of use (read or make) revealed that 12 questions involved a reading use, while 21 involved a making use, and one involved both. All but one, 91.6 per cent, of the twelve questions involving reading were ranked high enough to justify their inclusion in a course, while only 13, 61.7 per cent, out of 21 of the questions involving a making use ranked high enough to be included. This indicates that there is a greater use for reading drawing then there is for making it.

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On the basis of use made by parents, alumni, and pupils the following should be included in the proposed course: Making mechanical picture drawings 1. Making free-hand picture sketches 2. Making free-hand picture drawings in which 3. dimensions are included Reading free-hand picture sketches in which 4. dimensions are included 5. Making free-hand orthographic sketches 6. Reading free-hand orthographic sketches 7. Making mechanical orthographic sketches 8. Reading mechanical orthographic sketches Using drawing for the purpose of assembling 9. 10. Making sectional views 11. Reading sectional views 12. Doing lettering 13. Making diagrams 14. Reading diagrams 15. Making charts and graphs 16. Reading charts and graphs 17. Reading maps 18. Reading floor plans for houses or buildings 19. Using patterns or sheet metal drawings Using the scale Using the T-square and triangles 20. 21. In organizing these various activities into a course of study in graphic representation some of them may be combined and some may be used as a means in teaching others. Although there is no scientific basis for this order these activities will be presented as learning units in the order in which the writer intends to use them: 1. To do good lettering To make and read free-hand picture sketches 2. To make and read orthographic sketches 3. To use the T-square and triangles in ruling 4. lines--laying out a drawing sheet 5. To use the drawing scale To make and read orthographic drawings made 6. with drawing instruments To make and read drawings containing sectional 7. views

8.	То	use a drawing for the purpose of assembling
		an article or machine
9.	То	make mechanical pictorial drawings
10.	То	make and read charts and graphs
11.	То	make and read diagrams
12.	То	read sheet metal drawings
13.	То	read maps
14.	То	read floor plans of houses and buildings

If the learning units here can be presented in less time than is prescribed by the school authorities for the course, additional units may be selected from those which ranked highest of those which were excluded. (See Tables 38, 39, and 40, pages 67, and 68.) If, on the other hand, there are too many learning units to be covered in the time allotted those which ranked lowest (See Tables 38, 39, 40, pages 67, and 68) in the above list should be dropped from the course.

In using these learning units it seems advisable to precede each unit with a prognostic test to discover how well the pupil can already do the type of things called for. For instance, a boy may be able to read maps well enough so that no further school training in map reading is justifiable.

After this course has been used for several years a definite time allowance can better be assigned to each unit. This can be based on the average time required by the pupils in the particular school for a period of years.

This thesis study has not been attempted to discover or set up any teaching methods whereby each of these units can be taught. Although this study revealed

how frequently the average citizen had occasion to use the various types of graphic representation it did not show to what degree each of these is used. For instance, free-hand picture sketches are made frequently by more than 40 per cent of the parents, alumni, and pupils (See Table 2, page 29), yet there is no evidence of what kind of picture sketches these people made.

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In order for this study to be of the greatest value it should be followed by studies to determine: how much time should be used in presenting each unit, what are the best methods of teaching each of these units, and to what degree of complexity or difficulty each type of drawing is used by the average citizen.

Chapter VI SUMMARY OF FINDINGS

An analysis of previous studies revealed a wide variety of possible uses for graphic representation.

This study showed that parents who had not studied drawing use it less in their everyday life than those who had studied it.

A greater use was manifested for reading certain types of drawing than for making them.

The 21 types of drawing used daily or frequently by 25 per cent or more of two out of the three groups, parents, alumni, and teachers, and the types which rank in the upper two-thirds in two out of the three groups-when ranked on the basis of values of three for 'Daily' two for 'Frequently', and one for 'Seldom'-- were identical.

When the values mentioned above were assigned to the replies the use for certain types of drawing was found to be about seven times as great as the use for other types.

A course of study in graphic representation designed to meet the needs of the average citizen should include the following teaching units:

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To do good lettering l. To make and read free-hand picture sketches 2. To make and read orthographic sketches 3. To use the T-square and triangles in ruling 4. lines -- laying out a drawing sheet To use the drawing scale 5. 6. To make and read orthographic drawings made with drawing instruments 7. To make and read drawings containing sectional views 8. To use a drawing for the purpose of assembling an article or machine 9. To make mechanical pictorial drawings 10. To make and read diagrams To make and read charts and graphs 11. 12. To read sheet metal drawings 13. To read maps To read floor plans of houses and buildings 14. The need for several additional studies grew out

of this study.

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LETTER SENT WITH QUESTIONNAIRE TO PARENTS

Downers Grove High School Downers Grove, Illinois

To the Parents of Students of D. G. H. S.

In order that we may improve our course in mechanical drawing by offering as units of instruction those phases of drawing which the average citizen has a need for, I would appreciate your co-operation in answering the following questions which are for the purpose of discovering the various uses we have for drawing.

Below is a list of different types of graphic representations which appear in current literature. Will you kindly check in the proper space the extent to which you make use of any of these either in your daily work, hobby, or as a matter of getting general information.

If you think of other ways you have used mechanical drawing, will you please add them on the back of one of these sheets.

Thank you for your courtesy and trouble,

Very truly yours,

W. R. Cleveland

Instructor in Drawing

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LETTER SENT WITH QUESTIONNAIRE TO PARENTS

Downers Grove High School Downers Grove, Illinois

To the Parents of Students of D. G. H. S.

In order that we may improve our course in mechanical drawing by offering as units of instruction those phases of drawing which the average citizen has a need for, I would appreciate your co-operation in answering the following questions which are for the purpose of discovering the various uses we have for drawing.

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If you think of other ways you have used mechanical drawing, will you please add them on the back of one of these sheets.

Thank you for your courtesy and trouble,

Very truly yours,

Instructor in Drawing

LETTER SENT WITH QUESTIONNAIRE TO ALUMNI

Downers Grove High School Downers Grove, Illinois

To the Alumni of D. G. H. S.

In order to include in our drawing course those phases of the work which will be of most service to the student after he graduates, I am making a survey to ascertain to what extent the different phases of drawing are used.

Inasmuch as you have taken a course in drawing in the Downers Grove High School we feel that you are qualified to give information which will help us improve our work.

Your answers to the following questions will be appreciated.

Very truly yours,

2r.R. Cleveland

Instructor in Drawing

LETTER SENT WITH QUESTIONNAIRE TO ALUMNI

Downers Grove High School Downers Grove, Illinois

To the Alumni of D. G. H. S.

In order to include in our drawing course those phases of the work which will be of most service to the student after he graduates, I am making a survey to ascertain to what extent the different phases of drawing are used.

Inasmuch as you have taken a course in drawing in the Downers Grove High School we feel that you are qualified to give information which will help us improve our work.

Your answers to the following questions will be appreciated.

Very truly yours,

Instructor in Drawing

NOTE INCLUDED WITH QUESTIONNAIRES TO BE GIVEN OUT BY TEACHERS

Dear M____

These envelopes contain questionnaires which I am sending to the parents of students, picked at random from the student body.

Will you please pass them out, ask the students to have them filled out by Monday, if possible, and returned to you. You may then place them in my box. I am sorry that these have come at such a busy time, and I greatly appreciate any cooperation you may give me in helping to get them out and returned.

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QUESTIONS

indica types (descril (D) - (In answering these questions will you kindly te the degree of use you make of the different of drawing by encircling the letter which best bes your use: daily; (F) - frequently; (S) - seldom; (N) - never.
1.	Do you ever make picture drawings in which you use a straight edge or other drawing instruments? (A picture drawing shows the object as it appears to the eye, similar to a photograph). D. F. S. N.
2.	Do you ever make a free-hand picture sketch? D. F. S. N.
3.	Do you ever make a free-hand picture sketch in which you include dimensions? D. F. S. N.
4.	Do you ever read free-hand picture sketches which include dimensions? D. F. S. N.
5.	Do you ever make a free-hand multi-view or orthographic sketch of objects? In this type of drawing the front, top and side views of the object are drawn separately, as instead of as one view D. F. S. N.
6.	Do you ever read free-hand multi-view or orthographic sketches? D. F. S. N.
7.	Do you ever make multi-view or orthographic drawings by using a straight edge or other drawing instruments? Such drawings might include things which you intend to make or have someone make for you. D. F. S. N.
8.	Do you ever read multi-view drawings which have been made with instruments? Many such drawings which occur in megazines show how to make pieces of furniture, cabinets, and various appliances. D. F. S. N.
9.	Do you ever use a drawing for the purpose of assembling an article or machine? D. F. S. N.

10.	Do you ever make drawings in which there are sectional views (portions cut away to enable one to see the interior construction or to aid with assembling)? D. F. S. N.
11.	Do you ever read drawings containing sectional views? D. F. S. N.
12.	Do you ever make any mottoes or emblems such as are used in advertising, trade-marks, designs, stamps, medals, insignia, and the like? D. F. S. N.
13.	Do you ever do any lettering (place cards, filling out blanks, etc.) D. F. S. N.
14.	Do you ever make any posters on which lettering is required? D. F. S. N.
15.	Do you ever make any diagrams for the purpose of showing the relation of one object to another or to show the relation between parts? D. F. S. N.
16.	Do you ever read diagrams such as those used to explain the parts of the automobile and the oiling or greasing systems. Also diagrams with various electrical appliances such as radio, washing machines, etc? D. F. S. N.
17.	Do you ever make any charts or graphs such as organization chart, flow sheet, bar charts, line and curve graphs, pie charts, pictograms, etc.)? D. F. S. N.
18.	Do you ever read charts or graphs such as appear in the newspapers, magazines, and other literature? D. F. S. N.
19.	Do you ever make any silhouette drawings? D. F. S. N.
20.	Do you ever make any maps? D. F. S. N.
21.	Do you ever read any maps? D. F. S. N.
22.	Do you ever make any floor plans for houses or buildings? D. F. S. N.
23	Do you ever read any floor plans for houses or buildings, either in blue print form or as they appear in the magazines D. F. S. B.

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24. Do you ever make elevations for houses or buildings? D. F. S. N. 25. Do you ever read elevations for houses or buildings? D. F. S. N. 26. Do you ever make any picture sketches or drawings of a house or building? D. F. S. N. Do you ever make sketches or drawings previous to remodelling any part of your home? D. F. S. N. 27. 28. Do you ever make patterns or cut-outs of objects which are made out of thin material - paper, cardboard, or sheet metal? A drawing of this kind gives the unfolded view of an object. D. F. S. N. Do you ever use patterns, cut-outs, or sheet metal drawings? D. F. S. N. 29. 30. Did you ever have occasion to make or read a patent office drawing? D. F. S. N. 31. Have you ever had an idea you considered patentable but felt that you were unable to draw it properly to obtain a patent. D. F. S. N. 32. Do you ever use the scale (an instrument used for measuring in drawing) for making drawings to different scales? D. F. S. N. Do you ever use the T-square or triangles in 33. ruling lines for making office forms, borders, etc. D. F. S. N. 34. Do you ever use the ruling or inking pen for making ink lines? D. F. S. N. Have you studied drawing? Occupation_

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April 10, 1938

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To the Teachers of D.G.H.S

In order that the work offered in Liechanical Drawing may be of the greatest possible value to the student both in school and after he leaves school, I would appreciate your cooperation in answering the following questions. From your answers I hope to get information whereby our work in Drawing may be reorganized in such a way as to bring about a greater correlation between it and the other school subjects.

Thank you for your cooperation.

W. R. Cleveland

Do your students have occasion in preparation or presentation of their work to <u>make</u> any of the following types of graphic representations? Indicate the degree of use by underlining the letter (D) - daily; (F) frequently; (S) - seldom; (N) - never.

1. Free-hand picture sketches D. F. S. N.

- 2. Picture drawings in which a straight edge or other instruments are used D. F. S. N.
- 3. Free-hand multi-view sketches. In this type of drawing the front, top, and side views of an object are drawn separately as ______ instead of as one view ______ (picture sketch)
 D. F. S. N.

4.	Multi-view drawings by using a straight edge or
	other drawing instruments D. F. S. N.
5.	Drawings in which there are sectional views
	(portions cut away to enable one to see the
	interior construction) D. F. S. N.
6.	Diagrams for the purpose of showing the relation
	of one object to another or to show the relation
	between parts D. F. S. N.
7.	Charts or graphs D. F. S. N.
8.	Notebook covers in which lines or designs are
	drawn D. F. S. N.
9.	Lettering D. F. S. N.
10.	Maps D. F. S. N.
11.	Floor plans D. F. S. N.
12.	House or building elevations D. F. S. N.
13.	Patterns of objects which when folded up make the
	object D. F. S. N.
14.	Rule up forms D. F. S. N.
15.	Inked lines with ruling pen or compass D. F. S. N.
Do y	our students have occasion in preparation or
pres	entation of their work to <u>read</u> any of the following
type	s of graphic representations?
16.	Free-hand multi-view sketches or drawings D. F. S. N.
17.	Diagrams D. F. S. N.
ĺ8.	Charts or graphs D. F. S. N.

19. Maps D. F. S. N.

20. Floor plans D. F. S. N.

21. House or building plans D. F. S. N.

Dc you find (fewer) (about the same) (more) diagrams, charts, graphs, and line drawings in the text-books used today than in those used five or ten years ago?

IN OTHER	CLASSES
Type of Drawing	Number of Fimes Listed
Notebook covers	22
Lettering	21
Geometrical figures	12
Drawing lines	8
Making charts and graphs	8
Making sketches	8
Making diagrams	7
Using a compass	6
Map work	4
Reading drawings in textbooks	s 3
Space work	3
Sectional view of house	2
Plans for stage-setting	2
Using triangles	2
Drawing illustrations	1
Perspective drawing	1
Furniture drawing	1 .

TABLE 42 -- NUMBER OF TIMES PUPILS LIST USES OF DRAWING

ues- ion Jum-	Individual Questionnaires													
	1	2	C.J	4	5	6	7	8	9	10	11	12	13	14
1.	S	N	S	S	F	Fe1	F	S	S	S	F	S	F	D
2.	N	F	F	F	F	F	D	F	F	S	F	N	F	
3.	S	F	F	F	E	F	D	F	F	S	F	N		
4.	D	F	5	[ˈŦ	F	F	ŕ	F	F	F	F	F	F	
5.	S	F	F	S	S	F	F	F	F	S	F	S		
6.	D	D		F	N	F	P	F	F	F	F	S	S	
7.	N	S	F	S	Ν	F	Ţr,	S	F	F	F	F		
8.	F	D	D	F	S	F	[F	D	D	F	D	D	S	
9.	D	Ē	S	S	Ν	F		D	D	F	F	D	S	D
50 54														
ure 1 swers	•	Jam <u>r</u> eive	ole ed f	of ron	Mas 1 Pa	ster	s Sh	neet Al	: Us unr	seđ	in F and	lecor Teac	ding hers	the

QUESTIONS USED IN THE STUDY MADE BY MR. F. W. WALSH. Check the word which describes how much you have used the following: 1. Have you read a house or building plan? D. F. S. N. "Have you made a sketch, plan, or drawing of a house 2. or building? D. F. S. N. 3. Have you read the plans of a handy kitchen in a paper or magazine? D. F. S. N. *Did you ever make a tentative sketch or drawing 4. previous to remodelling a room or part of a building? D. F. S. N. 5. Have you ever made a sketch or plan of a garden or lawn with a view to making it more beautiful? D. F. S. N. Did you ever lay out and letter a sign of any kind? 6. D. F. S. N. 7. Did you ever lay out and cut a stencil? D. F. S. N. Have you ever helped your wife lay out a dress 8. pattern? D. F. S. N. 9. Have you ever enlarged, copied or reduced an embroidery design? D. F. S. N. 10. Have you ever built a piece of furniture from a drawing? D. F. S. N. 11. Have you ever sketched or drawn an interesting piece of furniture you intended to make or have made? D. F. S. N. 12. Have you ever read an automobile or machine oiling chart? D. F. S. N. 13. Have you made a sketch of a broken piece of equipment to send away for needed repair? D. F. S. N. 14. Have you ever read a graph or chart in a magazine, paper, or lecture made for the purpose of making comparisons, etc.? D. F. S. N. 15. Have you ever made a chart like the above? D. F. S. N. 16. Have you read a map? D. F. S. N. 17. Have you made a map? D. F. S. N. 18. "Have you had a patentable idea but felt that you were unable to properly draw it to obtain a patent? D. F. S. N. 19. *Did you ever make a patent office drawing? D. F. S. N. 20. "Have you ever assembled an article or machine from a drawing? D. F. S. N. 21. Have you read two drawings of a device which were made for the purpose of showing superiority of one over the other? D. F. S. N. 22. Have you taken measurements that required great accuracy? D. F. S. N.

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52 23. Have you built a radio set from a drawing? D. F. S. N. 24. Did you ever lay out a panel for the parts of a radio set? D. F. S. N. *Questions used by the writer in this study.

THESIS ABSTRACT

NON-VOCATIONAL COURSE CONTENT

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IN

GRAPHIC REPRESENTATIONS

Submitted by

William R. Cleveland

August 1938

ABSTRACT

Modern trends in education and the demands of every-day life make it imperative that all courses included in a high school program be under constant revision. We cannot assume that a course once valuable will always be valuable. Non-vocational courses should be recognized as such and their content so organized.

Thus, the problem of this thesis is: A study of the uses made of different kinds of graphic representation by the citizens of a residential suburb of a large commercial and industrial city, using as a type, Downers Grove, Illinois, a suburb of Chicago, Illinois, for the purpose of establishing a non-vocational course in the high school dealing with graphic representations.

The term "graphic representation" has been selected rather than the term "drawing" because of the narrow meaning often given to the latter. Drawing is usually thought of as pertaining to mechanical drawing or artistic drawing or both, but it is not thought of as including charts, graphs, diagrams, maps and sketches.

The basis upon which the proposed non-vocational course will be established is the uses revealed from the study.

The aim of the course is: to give the pupil training in reading and making the different kinds of graphic representations which the average citizen uses today.

Several studies have been made which were based on parents use of drawing in home life; pupil use in home life, drawings read in magazines and newspapers and space given in newspapers, magazines, mailed advertisements, and school library books. However, none of these include all three groups which are surveyed in this study, nor are all elements of the problem so definitely related to one community and its needs. Attention is also called to the fact that six years of great industrial growth has elapsed since the last of these studies was made. During this time the need for a course, such as proposed, has become more evident.

To secure the data needed for solving the problem undertaken three groups of people were called upon. These three groups were parents of the pupils, alumni who had studied drawing some time during the years 1930-1938, and teachers of the Downers Grove High School. The parents and alumni were questioned to determine their use for graphic representations while the teachers were interviewed to discover the use which pupils had for it in their school subjects and hobby clubs.

The data were gathered from the parents and alumni by the use of a questionnaire; the same questionnaire was used for both groups. The data were obtained from the

teachers by means of personal interviews.

The content of the questionnaire was developed from the findings of a study made by Mr. William P. Hale in which he reviewed 102 newspapers, 60 magazines, 126 mailed advertisements, and 158 school library books to discover how frequently drawings occurred in them; from questions used by Mr. Frank W. Walsh in his study of 1928 to determine the uses of mechanical drawing in every-day home life; and from other questions added by the writer.

The body of the questionnaire consisted of 34 questions some of which inquired whether a person read certain types of drawing and others whether he made them. A few questions asked whether he made use of certain common drawing room tools. The person answering the questionnaire was asked to indicate the extent to which he used the drawings by checking the letters D. (daily), F. (frequently), S (seldom), and N. (never). Two supplementary questions were added; the first of which was to determine if the respondents had studied drawing and the second was regarding their occupations or means of livelihood.

The interview questionnaire to be used with teachers was developed from a list made by the drawing pupils of the various ways in which they used mechanical drawing in their other school subjects.

In determining to which parents to send questionnaires a random selection was made from the names of

parents of all pupils in the high school. A total of 864 names were available after duplicate names were eliminated. These were placed on cards and these cards were shuffled. They were then dealt out by placing the first three cards on one pile and the fourth card on a second pile. This dealing was continued until all the cards were divided into two piles. The pile with every fourth card contained the names of 216 parents. Twenty parents out of this group were interviewed for the purpose of testing whether the questionnaire was within the comprehension of the average citizen. As a result of these interviews the questions were revised and put in their final form. These questionnaires were sent home by the children of those parents who had been selected; out of 196 sent out by this method 103 were returned. These with the 20 interviews made a total of 123 parent returns.

Questionnaires were sent by mail to all graduates who could be located who had been enrolled in a course in mechanical drawing in the high school during the last eight years. Out of 163 questionnaires sent out 45 were returned.

As the questionnaires were returned the replies were recorded on master sheets in such a way that the identity of the replies of each questionnaire was not lost. From these master sheets comparisons were made between the replies of those who had studied drawing and those who had not, and it was found that in every case those who had studied drawing made much greater use of it than those who had not.

The data on the master sheets were further analyzed and the following criteria were applied to them to determine which types of drawing should be included in a proposed course of study: that if 25 per cent or more of each of two out of the three groups replied that they used daily or frequently a certain type of drawing and that if in two groups of the three that same type of drawing ranked in the upper two-thirds of the answers after they had been arranged according to values then that type should be included. The values assigned each degree of use were three for 'daily', two for 'frequently', and one for 'seldom'.

This analysis revealed that 21 types of drawing should be included in the proposed course. It so happened that the types of drawing which satisfied the requirements of the first criterion were the same types which satisfied the requirements of the second criterion. The 21 types of drawing which were selected on the basis of use made of it by parents, alumni, and pupils were:

Making mechanical picture drawings 1. Making free-hand picture sketches 2. Making free-hand picture drawings in which 3. dimensions are included Reading free-hand picture sketches in which 4. dimensions are included Making free-hand orthographic sketches 5. Reading free-hand orthographic sketches 6. Making mechanical orthographic sketches 7. Reading mechanical orthographic sketches 8. Using drawing for the purpose of assembling 9. Making sectional views 10. Reading sectional views 11. 12. Doing lettering

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13. Making diagrams 14. Reading diagrams 15. Making charts and graphs 16. Reading charts and graphs 17. Reading maps Reading floor plans for houses or buildings 18. 19. Using patterns or sheetmetal arawings Using the scale 20. Using the T-square and triangles 21.

The 34 questions were analyzed on the kind of use (read or make) and the analysis revealed that 11 out of 12 questions involving a reading use were among those selected for the proposed course, and 13 out of the 21 questions involving a making use ranked high enough to be included in the course.

In organizing the 21 types of drawing into a course of study in graphic representation some of them may be combined and some may be used as a means in teaching others. The one aim of the course is: to give the pupil training in reading and making the different kinds of graphic representation which the average citizen uses today. The writer is aware of the fact that there are other objectives for the usual mechanical drawing course, and, no doubt, some of these other objectives can be fulfilled in this proposed course of study. Although there is no scientific basis for this order these types are presented as learning units in the order in which the writer intends to use them:

 To do good lettering
 To make and read free-hand picture sketches
 To make and read orthographic sketches
 To use the T-square and triangles in ruling lines--laying out a drawing sheet
 To use the drawing scale

6. To make and read orthographic drawings made with drawing instruments 7. To make and read drawings containing sectional views 8. To use a drawing for the purpose of assembling an article or machine 9. To make mechanical pictorial drawings 10. To make and read diagrams 11. To make and read charts and graphs 12. To read maps 13. To read sheet metal drawings To read floor plans of houses and buildings 14.

The proposed course of study is presented in outline form. No attempt is made to set up methods by which the various units should be taught. Neither are any exercises or plates proposed, nor does the element of time required to present each unit enter into consideration.

The need for several additional studies grew out of this study. Such studies should be made to determine: how much time should be used in presenting each unit, what are the best methods of teaching each of these units, and to what degree of complexity or difficulty each type of drawing is used by the average citizen.