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THE USE OF QUALITY AND RATING SCALES FOR EVALUATING INDUSTRIAL ARTS PROJECTS

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THE USE OF QUALITY AND RATING SCALES FOR EVALUATING INDUSTRIAL ARTS PROJECTS

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By
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ABSTRACT

The main objective of this study is to present to those who may be interested a means of objectively evaluating industrial art projects. The means used in this study were project rating and quality scales.

The information that was used in developing this study was acquired through research in the library on the campus of Kansas State Teachers College, Pittsburg, Kansas, and experiments carried out on the same campus.

CHAPTER I

INTRODUCTION

Introduction to the Problem

The process of education includes three major divisions: (1) the determination of goals or objectives, (2) the manipulation of materials and methods so that these objectives are achieved, and (3) the evaluation or appraisal of results obtained.[1] All three of these major divisions are equally important; however, in this thesis the third one, the evaluation or appraisal of results obtained, will be dealt with.

> Measurement in its various forms and phases appears to be recognized as an integral part of good classroom procedure. In no instructional field is there greater need for the application of the principles of educational measurement than in industrial education. Industrial education teachers and supervisors need reliable measuring instruments in order to give more adequate educational guidance, to evaluate personality traits, to motivate learning, to study the effectiveness of teaching materials and methods, to measure pupil progress more accurately through the establishment of more definite standards of performance and through the diagnosis of pupil difficulties.[2]

These instruments and standards of measurement must be made as objective as possible. The instructor must have

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[1]A. M. Jordan, Measurement in Education (New York: McGraw-Hill Book Company, Inc., 1953), p. 3.

[2]L. V. Newkirk and H. A. Greene, Tests and Measurements in Industrial Education (New York: John Wiley & Sons, Inc., 1935), p. 1.

something substantial to base his evaluations on, so that when the student asks why he received a certain mark, the instructor can show him what his mark was based upon.

Statement of the Problem

This thesis is primarily an investigation of two types of scales which could be used very effectively in evaluating industrial arts projects. It is the description of quality and rating scales, their construction, reliability, and the uses of each.

Need for the Study

Since the beginning of industrial arts, the teachers in this field have been searching for a more objective means of grading projects constructed in their classes. Down through the years the grading of such projects has been largely on a subjective basis.

The rating of shop projects and drawings is a difficult problem in measurement which is faced by practically all industrial education teachers. The assignment of a quantitative rating or grade to a shop project such as a chair, a radio, a lamp, a funnel, a dustpan, or an isometric drawing calls for the keenest of discrimination of work done on the project and for some method of objectifying standards of quality. The greatest difficulty in grading or rating such

products appears to be related to what degree they will vary from the typical. For instance, a shop project which shows excellent design, a poor finish, square edges, weak joints, rough surfaces, and carefully rounded corners would be difficult to judge. If the design is given undue consideration, the project will be rated too high. If only the joints and surfaces are considered, the pupil may fail on the project.[3]

As one may easily see from the past example, it would be advantageous to both the shop instructor and the pupil if a better means of evaluating shop projects were used. However, it may readily be seen that even with scales, there will be subjectivity in evaluating projects. One can never succeed in eliminating all subjectivity, but only wish to eliminate it to the highest degree possible.

Purpose of the Study

The purpose of this thesis is to show a more standard means of evaluating industrial arts projects, other than the instructor just assigning the project a grade. In the past, the instructors have based the grades of projects upon their own judgment. With the use of rating and quality scales the grading of projects becomes more objective, and if used properly, the student will have a better understanding of what his grade is based upon.

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[3] *Ibid.*, p. 150.

It is also desired that the reliability of rating and quality scales can be brought out in this work. However, it does not attempt to remove subjectivity completely but rather to eliminate it to the highest degree possible.

Limitations of the Study

This study is limited in the following ways:

1. To the field of industrial arts.
2. To the use of two types of scales (project rating and quality).
3. To information of materials and related materials found in the library at Kansas State Teachers College, Pittsburg, Kansas.
4. To scales constructed and experimented with by the writer of this thesis.

Method of Procedure

In this study, a thorough investigation was made of the work done in the past with scales in other fields. An attempt has been made to gain a good overall picture of past work by doing research in the library and observing in the industrial arts department.

After obtaining as much knowledge on rating and quality scales as possible, the writer then constructed scales and conducted experiments using KSTC graduate students attending

the summer session of 1954. After completing these experiments, the data were compiled and presented as a basic part of the study.

Definitions

For clearness in thought the following words are defined to mean:

Rating scales: Measuring devices which set up levels of qualities or products for the guidance of judges in evaluating such qualities or products in the classroom or shop.[4]

Quality scale: A device which measures by comparison with a set of standard specimens the result of applying some specific skill.[5]

Industrial arts: Those phases of general education which deal with industry--its organization, materials, occupations, processes, and products--and with the problems resulting from the industrial and technological nature of society.[6]

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[4] Ibid., p. 247.

[5] Ibid.

[6] G. O. Wilbur, Industrial Arts in General Education (Scranton: International Textbook Company, 1948), p. 2.

CHAPTER II

HISTORY AND RELATED STUDIES OF RATING AND QUALITY SCALES

In the past years there have been many types of rating and quality scales used to rate or to determine the quality of many different things. It would be difficult to list or explain all the rating and quality scales which have been constructed and used. However, a few will be listed to show how they have developed with time.

As early as 1910, Edward L. Thorndike of the Teachers College, Columbia University, published the first handwriting scale. This particular scale could be called a rating or a quality scale. It was used to rate the quality of students' handwriting on the elementary level. The publication of this scale was considered a most important contribution to the entire movement for the scientific study of education.[1]

It was after Thorndike had completed and published his handwriting scale that other men in the field of education began to develop different types of rating scales to be used as instruments of measurement. L. P. Ayres developed scales to use in spelling, C. Woody used scales to measure achievement in arithmetic, and Dr. M. B. Hillegas developed a scale

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[1]William A. McCall, <u>How to Measure in Education</u> (New York: The MacMillan Company, 1922), p. 260.

for the measurement of English composition at a secondary level.[2]

Another type of rating scale used in the field of education is the personality rating scale. Such scales are based on points believed to be outstanding personality traits. Some of these scales have been used by teachers in judging students' personalities, while others were used by the students to rate the instructors. However, according to material reviewed before the preparation of this report, it was believed that this particular type of rating scale had very little reliability due to poor construction and to the fact that some instructors were too lenient while others were much too critical. Also, the points that they were rated upon were so intangible that there was a great deal of subjective rating.

Introduction into Industrial Arts

The introduction of rating scales into industrial arts, according to information available, was in the late 1920's and early 1930's. Probably the best known early work is that of D. L. Paterson, R. M. Elliott, L. D. Anderson and others presented in the book, Minnesota Mechanical Ability Tests. In this particular study, rating and quality scales were used

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[2]Marion R. Trabue, Measuring Results in Education (New York: American Book Company, 1924), pp. 449-466.

to help determine the mechanical ability of junior and senior high school students attending the Minneapolis public schools.

Paterson, Elliott, Anderson and others used all types of shop work in their tests; for instance, sheetmetal, woodwork, electricity, and mechanical drawing. They found that the use of rating and quality scales gave very good results in determining the mechanical ability in all types of shop work.[3]

Later, in 1936, L. V. Newkirk and H. A. Greene published a book on Tests and Measurements in Industrial Education in which an entire chapter[4] has been devoted to rating and quality scales.

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[3]D. L. Paterson, R. M. Elliott, and L. D. Anderson, Minnesota Mechanical Ability Tests (Minneapolis: The University of Minnesota Press, 1930), p. 194.

[4]Newkirk and Greene, op. cit., Chapter VII.

CHAPTER III

CONSTRUCTION AND RELIABILITY OF SCALES[1]

One problem confronting shop instructors in their rating of projects is the definition of objective standards of quality. Many may realize that the rating of shop projects is subjective and unreliable; however, they will not or cannot find a more objective or reliable means of rating the pupil's project. In general, the suggestion for improving the rating of shop projects is to group all phases of the project, and then rate them all together.

Construction of Project Rating Scales

In the construction of project rating scales, there are a few principles which have been found very helpful. They are the following:

1. Make a careful analysis of work to be covered. In general, select the most important factors as items to be rated.

Example: (Woodwork class) Utility, joints, squareness of individual parts, proportions, durability, sawed edges, boring, sanding, curves, finish, cost, use of material, and simplicity.

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[1] *Ibid.*, pp. 150-170.

2. Group these factors into classes according to method of rating.

Example: (Woodwork class)
- Design
  - Utility
  - Durability
  - Proportions
  - Simplicity
- Physical Measurement
  - Squareness of Individual Parts
  - Identical Parts
  - Squareness to Each Other
  - Curves
- Inspection of Project
  - Glue Joints
  - Screw Joints
  - Sawed Edges
  - Boring
- Finish
  - Sanding
  - Finish
- Social-Economical
  - Cost
  - Feeling of Ease
  - Use of Material

3. Place these factors into a rating scale so each factor may be rated individually and, so the ratings may then be combined.

At times there will be numerous factors which are less tangible and may be rated better with a quality scale especially developed for the purpose. Lettering, sewing, soldering, and splicing are examples of this type.

4. Make out a set of directions for the use of the rating scale.

A project rating scale must have a set of good directions which explain in simple, direct language how it is to be used.

Also, a place should be provided for the pupil's name, name of project, judge's name, date the project was completed, name of school, and the total score received on the project.

The following is a copy of the rating scale devised during this study. It was used by 23 graduate students who rated three projects in woodwork in order that a coefficient of reliability of the rating scale could be determined.

RATING SCALE FOR WOODWORK PROJECTS

Name ______________________________

Project ______________________________

School ______________________________ Date ____________

Name of Judge ______________________ Score ____________

Directions: On each item draw a circle around the figure on the scale to indicate your rating of that item. There are ten (10) figures on the scale, therefore, ten (10) will be the highest mark you may give to any one item.

I. Design

1. Will the project serve the purpose for which it is intended? 1 2 3 4 5 6 7 8 9 10

2. Does it have the needed durability? 1 2 3 4 5 6 7 8 9 10

3. Is it good in proportions, in mass, and in detail? 1 2 3 4 5 6 7 8 9 10

4. Does it have simplicity throughout all parts? 1 2 3 4 5 6 7 8 9 10

5. Will the project fit into the environment in which it is to be placed? 1 2 3 4 5 6 7 8 9 10

II. Physical Measurement

1. Are individual parts in true squareness? 1 2 3 4 5 6 7 8 9 10

2. Are parts identical when meant to be? 1 2 3 4 5 6 7 8 9 10

3. Are parts square to each other? 1 2 3 4 5 6 7 8 9 10

4. Are curves as specified on drawing? 1 2 3 4 5 6 7 8 9 10

III. Inspection of Project

1. Are glue joints properly fitted? 1 2 3 4 5 6 7 8 9 10

2. Are screw joints properly fitted? 1 2 3 4 5 6 7 8 9 10

3. Have the sawed edges been covered or properly finished? 1 2 3 4 5 6 7 8 9 10

4. Have holes been properly bored? 1 2 3 4 5 6 7 8 9 10

IV. Finish

1. Has project been well-sanded? 1 2 3 4 5 6 7 8 9 10

2. Is finish smooth? 1 2 3 4 5 6 7 8 9 10

V. Social-Economical

1. Does project have the value implied in cost? 1 2 3 4 5 6 7 8 9 10

2.	Does the project make you feel at ease?	1 2 3 4 5 6 7 8 9 10
3.	Is material and workmanship honest?	1 2 3 4 5 6 7 8 9 10

Construction of Quality Scales

Quality scales may be used very effectively as an instrument of measurement by the shop instructor. A sheet-metal instructor, for instance, may place a group of specimens constituting a scale in seam construction, riveting, wiring, or turning on a board and hang them on the wall where they can be seen by all the students in the classroom. Once this has been done, the students may start rating their own projects and may further develop a concept of what constitutes real quality of workmanship.

In the construction of quality scales the following steps are essential:

1. Secure a representative number of samples of work. These samples must have a wide range of quality of work, extending from superior to very poor. Sometimes it will become difficult to secure the two extremes; the instructor must then make a few samples and add them to the list.

2. Secure independent estimates of relative quality of the samples. To do this, remove the names of the pupils from the samples and place letters or numbers on them so

they may be readily identified when needed to be. The judges must not know who has made the sample, as it might influence their rating of that sample. After the samples have been properly labelled, give them to the judges individually in random order. The judges should then be instructed to arrange them in order from best, to poorest, by comparison. The judges should be men who are competent in the field of work of the samples.

Table I gives the order in which the eight judges have arranged 14 cards of lettering. The cards are designated by letters.

TABLE I

RANKING BY EIGHT JUDGES

	High 1	2	3	4	5	6	7	8	9	10	11	12	13	Low 14
Judge 1	B	N	K	G	I	A	L	C	D	E	H	F	M	J
" 2	N	B	G	I	K	A	D	E	L	M	C	F	H	J
" 3	B	G	N	K	I	H	A	D	L	J	M	C	E	F
" 4	B	G	N	I	K	H	L	E	A	J	C	F	D	M
" 5	G	B	N	I	D	K	A	H	L	M	C	E	F	J
" 6	B	G	I	N	K	C	E	F	L	H	A	D	M	J
" 7	N	B	G	I	K	E	A	L	D	F	H	C	M	J
" 8	B	N	G	K	I	A	L	E	D	F	H	C	M	J

3. With the information from Table I, one must then determine the number of judges rating each sample better than the others. This is done by using a Table such as Table II, page 16.

4. With Table II, page 16, complete you may find the order of merit by referring to the total scores. The sample with the highest total is considered to be of highest quality, the one with the second highest total is second and so on. This information indicates the relative order as given by the combined judges.

5. Using Table II, page 16, find the percentage of judges rating each specimen better than another, as done in Table III, page 17.

6. Using the percentages established in Table III, page 17, proceed to find the deviation from the median (50 per cent). These deviations should be expressed in either a positive or a negative deviation (Table IV, page 18). All cases of 100 per cent may be omitted from the Table as they do not effect the results.

7. The next step is to change the percentage of the deviation from the median to sigma unit differences. This is done by using Table 51 in E. L. Thorndike's Mental and Social Measurements, (Table V, page 19).

TABLE II

NUMBER OF JUDGES RATING SAMPLE INDICATED
IN HORIZONTAL LISTS AS BETTER THAN THOSE
IN THE VERTICAL COLUMNS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A		8	1	1	3	1	8	3	8	0	8	2	0	8
B	0		0	0	0	0	1	0	0	0	0	0	0	2
C	7	8		5	4	2	8	5	8	2	8	7	3	8
D	7	8	3		4	2	8	5	8	1	7	5	0	8
E	5	8	4	4		0	8	3	8	1	8	5	2	8
F	7	8	6	6	8		8	4	8	2	8	7	3	8
G	0	7	0	0	0	0		0	0	0	0	0	0	4
H	5	8	3	5	5	4	8		8	0	8	5	1	8
I	0	8	0	0	0	0	8	0		0	2	0	0	7
J	8	8	6	7	7	6	8	8	8		8	8	6	8
K	0	8	0	1	0	0	8	0	6	0		0	0	8
L	6	8	1	3	3	1	8	3	8	0	8		0	8
M	8	8	5	8	6	5	8	7	8	2	8	8		8
N	0	6	0	0	0	0	4	0	1	0	0	0	0	
TOTALS	53	101	29	40	40	21	93	36	79	8	73	47	15	86
	9	14	4	6	7	5	13	5	11	1	10	8	2	12

TABLE III

PERCENTAGE OF JUDGES RATING EACH SPECIMEN BETTER THAN ANOTHER

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A		100.0	12.5	12.5	37.5	12.5	100.0	37.5	100.0	0.0	100.0	25.0	0.0	100.0
B	0.0		0.0	0.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	25.0
C	87.5	100.0		62.5	50.0	25.0	100.0	62.5	100.0	25.0	100.0	87.5	37.5	100.0
D	87.5	100.0	37.5		50.0	25.0	100.0	37.5	100.0	12.5	87.5	62.5	0.0	100.0
E	62.5	100.0	50.0	50.0		0.0	100.0	37.5	100.0	12.5	100.0	62.5	25.0	100.0
F	87.5	100.0	75.0	75.0	100.0		100.0	50.0	100.0	25.0	100.0	87.5	37.5	100.0
G	0.0	87.5	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	50.0
H	62.5	100.0	37.5	62.5	62.5	50.0	100.0		100.0	0.0	100.0	62.5	12.5	100.0
I	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0		0.0	25.0	0.0	0.0	87.5
J	100.0	100.0	75.0	87.5	87.5	75.0	100.0	100.0	100.0		100.0	100.0	75.0	100.0
K	0.0	100.0	0.0	12.5	0.0	0.0	100.0	0.0	75.0	0.0		0.0	0.0	100.0
L	75.0	100.0	12.5	37.5	37.5	12.5	100.0	87.5	100.0	0.0	100.0		0.0	100.0
M	100.0	100.0	62.5	100.0	75.0	62.5	100.0	87.5	100.0	25.0	100.0	100.0		100.0
N	0.0	75.0	0.0	0.0	0.0	0.0	50.0	0.0	12.5	0.0	0.0	0.0	0.0	

TABLE IV

PERCENTAGE OF DEVIATION FROM MEDIAN (50 PER CENT)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A			-37.5	-37.5	-12.5	-37.5		-12.5				-25.0		
B							-37.5							-25.0
C	+37.5			+12.5	0.0	-25.0		+12.5		-25.0		+37.5	-12.5	
D	+37.5		-12.5		0.0	-25.0		-12.5		-37.5	+37.5	+12.5		
E	+12.5							-12.5		-37.5		+12.5	-25.0	
F	+37.5		+25.0	+25.0				0.0		-25.0		+37.5	-12.5	
G		-12.5												0.0
H	+12.5		-12.5	+12.5	+12.5	0.0						+12.5	-37.5	
I											-25.0			+37.5
J			+25.0	+37.5	+37.5	+25.0							+25.0	
K				+37.5					+25.0					
L	+25.0		-37.5	-12.5	-12.5	-37.5		-12.5						
M			+12.5		+25.0	+12.5		+37.5		-25.0				
N		+25.0					0.0		-37.5					

TABLE V

SIGMA DIFFERENCES EXPRESSED AS DEVIATION[2]
FROM MEDIAN (50 PER CENT)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A			-1.15	-1.15	- .32	+1.15		- .32				- .67		
B							-1.15							- .67
C	+1.15			+ .32	0.00	- .67		+ .32		- .67		+1.15	- .32	
D	+1.15		- .32		0.00	- .67		- .32		-1.15	+1.15	+ .32		
E	+ .32							- .32		-1.15		+ .32	- .67	
F	+1.15		+ .67	+ .67				0.00		- .67		+1.15	- .32	
G		- .32												0.00
H	+ .32		- .32	+ .32	+ .32	0.00						+ .32	-1.15	
I											- .67			+1.15
J			+ .67	+1.15	+1.15	+ .67							+ .67	
K				+1.15					+ .67					
L	+ .67		-1.15	- .32	- .32	-1.15		- .32						
M			+ .32		+ .67	+ .32		+1.15		- .67				
N		+ .67					0.00		-1.15					

[2]Edward L. Thorndike, <u>Theory of Mental and Social Measurement</u> (New York: Teachers College, Columbia University, 1916), p. 219.

8. Upon completion of the Table on sigma differences, the next step is to compute the scale differences. The formula for obtaining the scale differences is as follows:

$$S_{s\sigma} = \frac{\sqrt{2} \cdot x1k - x2k}{N}$$

in which $S_{s\sigma}$ equals the scale separation of the samples in sigma units, x1k - x2k equals the sum of the sigma unit differences for the two samples, and N is the number of such differences.[3]

Example: Difference of Samples A and L.

A	L	Sigma Unit Differences
+1.15	+1.15	0.00
+1.15	+ .32	.83
+ .32	+ .32	0.00
+1.15	+1.15	0.00
+ .32	+ .32	0.00
		.83

$$\text{Scale Difference} = \frac{\sqrt{2} \cdot .83}{5} = \frac{1.414 \cdot .83}{5} = \frac{1.1736}{5} = 0.23$$

In Table VI, page 21, are the scale differences between samples from low to high. It can be found from this Table the distance from F - C, which is .75 sigma units, and on the same scale the distance between L - A is .23 units.

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[3] L. E. Thurstone, Journal of General Psychology, pp. 405-423, as quoted in L. V. Newkirk and H. A. Greene, Tests and Measurements in Industrial Education (New York: John Wiley & Sons, Inc., 1935), p. 164.

TABLE VI

SCALE DIFFERENCES BETWEEN SAMPLES

Samples	Difference in Units
J-M	.33
M-F	.25
F-C	.75
C-H	.83
H-D, E	.30
D, E-L	.63
L-A	.23
A-KIN	.26
KIN-G	.68
G-B	1.04

9. The last step is to set up the linear scale, with the samples placed from low to high. For setting up a point of origin on the scale for industrial education purposes, it has been found advisable to select a point from 0.8 to 1 above zero. If the point of origin were set at zero on a quality scale in lettering such as the one shown in the past pages, the lettering plate at zero would have no lettering on it. The linear scale is shown in Figure 1, page 22.

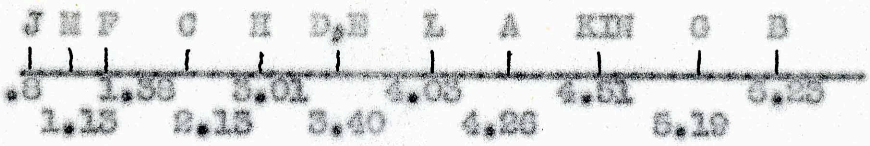

FIGURE 1

SPECIMENS ASSIGNED TO A LINEAR SCALE
(ZERO ASSUMED TO BE .8 BELOW SAMPLE J)

In the case of KIN, the judges ranked them so close that it may be safe to assume that there is very little difference as there are no contrasting points.

Figure 2, page 23, shows a photograph of the scale of quality for lettering plates as worked out in this study.

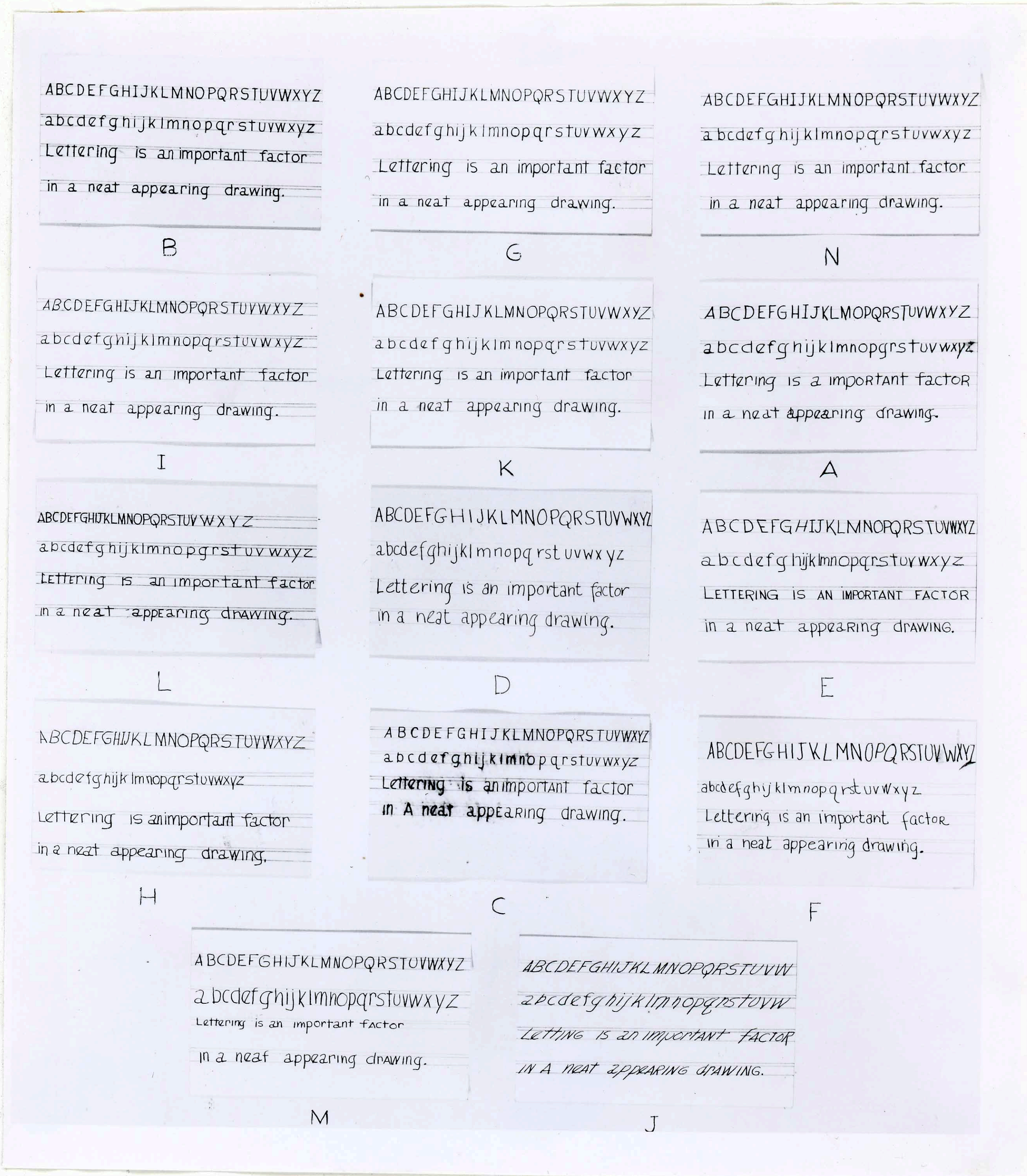

FIGURE 2

SCALE OF QUALITY FOR LETTERING PLATES

Reliability of Project Rating and Quality Scales

The question of the reliability of project rating and quality scales as a measuring instrument may be asked. The reliability of both project rating and quality scales was found to be high by Paterson, Elliott, Anderson and others in developing a criterion of mechanical ability.[4]

In the use of quality scales these workers found the average reliability of ten qualified judges to be .90 or better. It was also found that the judgment of two or more judges raised the reliability of quality scales.[5]

The reliability of the rating scale used in this study has the average coefficient of .85. This was established by using the Spearman Rank Difference Correlation method on a group of the total scores in the rating of three projects by twenty-three judges. A correlation was run between projects 1 and 2, 2 and 3, and 1 and 3; the three correlations were then averaged.

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[4]Paterson, Elliott, Anderson and others, op. cit., p. 103.

[5]Newkirk and Greene, op. cit., p. 169.

TABLE VII

RANK DIFFERENCE CORRELATION BETWEEN PROJECTS 1 AND 2

Project 1	Project 2	R_1	R_2	D	D^2
144	140	14	12	2	4
138	124	15	14.5	.5	.25
150	129	12	13	1	1
132	113	16	22	6	36
107	119	22	18.5	3.5	12.25
166	160	3	4.5	1.5	2.25
124	123	18	16	2	4
157	143	9.5	11	1.5	2.25
145	150	13	10	3	9
118	114	20	20.5	.5	.25
157	120	9.5	17	7.5	56.25
160	153	7	8	1	1
129	124	17	14.5	2.5	6.25
46	82	23	23	0	0
113	119	21	18.5	2.5	6.25
176	169	1	1	0	0
165	159	5	6	1	1
155	152	11	9	2	4
121	114	19	20.5	1.5	2.25
159	164	8	3	5	25
165	155	4	7	3	9
171	160	2	4.5	2.5	6.25
162	166	6	2	4	16
TOTAL					204.50

The procedure for using the Spearman Rank Difference method is as follows: (Table VII)

Step 1. Place the score of project 1 in the first column and the score given by the same judge to project 2 in the second column.

Step 2. Rank the scores of column 1 in column 3 (R_1) in the following manner. The highest score is ranked as 1, the second highest is ranked as 2, and so on.

Step 3. Rank the second list of scores in the same manner in column 4 (R_2). In case of identical scores, add the next's ranks together and divide by the number of scores added.

Step 4. For every pair of ranks, determine the difference by subtracting the large from the small and place in column 5 (D). Pay no attention to algebraic sign as these numbers are to be squared.

Step 5. Square the difference to find D^2 (column 6).

Step 6. Find the sum of the squares of the differences.

Step 7. Compute the coefficient (Greek letter rho) by means of the formula $\rho = 1 - \frac{6 \Sigma D^2}{N(N^2 - 1)}$

where ΣD^2 equals the sum of the squared difference between ranks and N equals the number of pairs of measurement.[6]

Example: $\rho = 1 - \frac{6 \cdot 204.50}{23 \cdot 528}$

$\rho = 1 - \frac{1227}{12144}$

$\rho = 1 - .10$

$\rho = .90$

By this procedure, then, the estimate of the amount of reliability is .90 between projects 1 and 2.

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[6] J. P. Guilford, Fundamental Statistics in Psychology (New York: McGraw-Hill Book Company, Inc., 1950), pp. 310-12.

CHAPTER IV

USES OF QUALITY AND RATING SCALES

The good industrial arts program of today is a fitting memorial to those philosophers of education in the seventeenth century--Rabelais, Comenius, and Rousseau, who advocated a broader, more practical education keyed to the activities of everyday life. The industrial arts programs of today take into consideration "the whole boy", and establish within the school a program for the education of work and paralleled with the education of culture.[1]

Teaching Consumer Education

Some shop instructors still seem to feel that their job in the school is to familiarize the student with the tools used to construct projects. Once this has been accomplished, he gives the student a drawing of a project and tells him to go to work. When the project has been completed, the instructor may check the student's work and explain what he has done right or wrong, or he may just assign the student any grade he desires to give that particular student.

However, there are a great many more shop instructors who feel that their job does not stop after familiarising

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[1]Maurice F. Richards, "Objective Testing in Industrial Arts," The Industrial Arts Teacher, (February, 1954), p. 13.

the student with the tools and assigning of a project. These instructors feel the student should be taught how to use the tools, the proper care of tools and equipment, why projects are constructed a certain way, and many other industrial principles. To train an individual by this means, is to train him to be an intelligent, appreciative, economical consumer of products.[2]

Project rating and quality scales could be used very well to bring out and better help the student in attaining this goal. By using these scales, the student can learn to appreciate the skill and workmanship that has been placed not only in their own project but in the products he will be buying throughout the rest of his life. The student may become more critical and better acquainted with what is economical for him to buy, and especially to show him what would be best for him for the amount of money he may place in the product. The instructor of shop work has the ideal opportunity to make this distinct contribution to a child's education if he desires to do so.

Grading Shop Projects

The project rating and quality scale used properly in a classroom may be beneficial to both the instructor and the student. The instructor using quality scales not only has a

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[2] Emanuel E. Ericson, "Grading Shop Work," Industrial Education Magazine, (January, 1927), p. 259.

very good visual aid on hand, but has a more objective means of evaluating the student's workmanship. For example, if a student of drawing has a lettering card such as the ones shown on page 23, Figure 2, he may see what he has done wrong, and how he may improve on his own lettering. Also, the instructor may show the student where his card would be placed in the scale and thus give the student a better understanding of why he received the grade he did on that particular card.

Rating scales may be used in grading in about the same manner. The instructor can explain the scale to the student so he will know just what his project is to be graded upon. The student will then be aware of what to look for and will do his best on the project so he can receive a high rating.

Rating and quality scales can also help the student to learn to judge and appreciate the value of his own work. Learning to evaluate one's own work in life is a valuable trait, and this may be accomplished without the loss of the value of the teacher's judgment. Under normal shop conditions, the student will still be eager for the instructor to pass judgment on his work.[3]

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[3]Emanuel E. Ericson, Teaching Problems in Industrial Arts (Peoria: The Manual Arts Press, 1930), p. 80.

CHAPTER V

SUMMARY AND CONCLUSION

Summary

The evaluating of shop projects is one of the many problems confronting the industrial arts instructor of today. Some instructors have no objective means of grading shop students and others have their own system. The use of project rating and quality scales could help eliminate these subjective systems. By using scales, you cannot hope to eliminate all subjectivity, but with the use of such scales it may be eliminated to a high degree.

Using project rating and quality scales not only gives the industrial arts instructor a more objective means of evaluating students' work, but they may also be used as teaching aids. By using quality scales the students can see, handle, and inspect, the different qualities of workmanship in a particular field. The student can also get a better idea of what is expected of him. This may also be done using project rating scales.

The construction of project rating and quality scales, as shown in this study, is simple, but time consuming. However, one must consider that when he completes the scale or scales, he has something on hand that may be used for a

length of time. He must also consider that once completed, he may make revisions in a short while to keep his scales abreast of the times.

Conclusion

On the basis of this study, it can be concluded that the industrial arts instructor who wants a means of evaluating shop projects with a higher degree of reliability may use project rating or quality scales.

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