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A SUGGESTED METHOD FOR SELECTING TEXTBOOKS FOR INDUSTRIAL ARTS COURSES IN HIGH SCHOOL

(TITLE)

BY

MERWYN ALLEN KLEHM

PLAN B PAPER

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE MASTER OF SCIENCE IN EDUCATION
AND PREPARED IN COURSE

INDUSTRIAL ARTS 560

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY,
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1963
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I HEREBY RECOMMEND THIS PLAN B PAPER BE ACCEPTED AS
FULFILLING THIS PART OF THE DEGREE, M.S. IN ED.

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Nov. 15, 1963
DATE

[redacted]
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INTRODUCTION

In current educational practices a general agreement has been suggested as to the general aims of industrial arts. In the achievement of these objectives, the selection of suitable textbooks and reference materials is of major concern. The use of textbooks and reference material in shop courses is growing. According to Bulletin 34, U. S. Office of Education Publication:

> The time has now arrived where a library of good books is an essential part of the equipment of every progressive industrial arts shop, and evidence of their frequent use is an indication of one factor in good teaching. To the extent that books are used to stimulate self-activity on the part of pupils, they become teaching aids.[1]

This statement is as true of the use of textbooks in industrial arts teaching as that of reference books. When we select or rate a textbook, the question arises as to what determines its desirability. Certain factors, such as readibility, attractiveness, suitability, and general utility are present more or less in all textbooks, but teachers in the field face the problem of selecting books with few or no standards.

> In respect to the need of standards, we will find that we couldn't get along in our daily life without standards. Take money, for instance with the standard of value, the dollar. Every single advertised product is built-up to a standard of quality of some kind

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[1] Industrial Arts: Its Interpretation in American Schools. (U. S. Office of Education Bulletin, No. 34, 1945).

> or other . . . the common foot rule is another standard we all need in everyday life. Standards are not new . . . they are proven in many ways actually to be necessary and have gained general acceptance throughout the nation.[1]

Hall-Quest[2] and Jensen[3] have set up standards and score cards for the rating of textbooks in history, arithmetic, geometry, mathematics, physics, reading, spelling, and language. Yet, there appears to be no definite criteria to assist in the rating or selection of textbooks in the field of industrial arts. At this point, the question might arise as to why use textbooks in shop teaching? The following reasons have been suggested:

1. Textbooks encourage the covering of a definite scope of work.
2. They check the instructor.
3. They fix the responsibility on the students.
4. Practice in reading is necessary.
5. Books specify standards.
6. Books assist in teaching.
7. They are the economical investment.[4]

These, then, are the basic reasons why textbooks should be used in our industrial arts shops. Textbooks, however, should not take the place of personal instruction. When the use of a text causes the teacher to retire to his office or desk, the textbook is being used as a substitute.

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[1]Ken McKierman, Why Argue About Standards? (Inland Printer, XCIX, April, 1947).

[2]Alfred L. Hall-Quest, The Textbook (New York: The MacMillan Co., 1945) pp. 87-120.

[3]Frank A. Jensen, Current Problems in Selecting Textbooks (Philadelphia: F. B. Lippincott Co., 1947).

[4]Emanuel E. Ericson, Teaching the Industrial Arts (Chas. A. Bennett Co., Peoria, Illinois, 1956), pp. 152-154.

PURPOSE OF THE STUDY

No longer can we depend upon random experiences as being wholly satisfactory for learning in our present-day society. The experiences in industrial arts courses must be carefully chosen so that the best use of class time is made. Materials of instruction and manipulative processes must be carefully selected, organized, and taught.

The purpose of this study is to develop a method of rating the contents of industrial arts textbooks in respect to two important areas of student development; namely, manipulative techniques and subject matter information. Teachers or supervisors who rate books need some form of evaluation. As each book is evaluated, its relative value may be checked and recorded on the rating scale.

Four general metal textbooks using the prescribed rating sheet will be rated. They are:

F. E. Tustison, Metal Work Essentials, (Milwaukee: The Bruce Publishing Co., 1936).

John L. Feirer, General Metals, (New York: McGraw-Hill Book Co., 1959).

Roland R. Fraser and Earl L. Bedell, General Metal, (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1955).

Oswald A. Ludwig, Metal Work Technology and Practice, (Bloomington, Illinois: McKnight and McKnight Publishing Co., 1955).

CRITERIA RELATING TO THE FORMAT OF A TEXTBOOK

The problem of selecting suitable textbook and reference material in the industrial arts field is important and is becoming more so as the number of such publications increases. This large increase of available publications magnifies the problem of selecting textbooks to meet the instructional needs of a specific course of study.

There are certain general factors which appear to be the most common criteria in judging textbooks.

The physical construction of the textbook is to be considered first. The binding and cover of a textbook makes a definite impression on the user. The cloth-covered book is more serviceable than the paper back because of its greater length of service which surely is an item worthy of consideration. Also, the cloth-covered textbook is more likely to be nonresistant to grease, grime, and dust. Books which are bound so that they can open flat cause less eyestrain than those which will not lie flat. Also, the color and general appearance of the textbook frequently has a definite effect on the user's desire to see what is within the book.

The title of the textbook adds to or detracts from the general impression of the book.

> A brief title, rather than a lengthy one, is preferable because considerable length requires more time to read and indicates that the book might be too complicated to use. Titles which are striking and a little out of the ordinary are more appealing to high school pupils, promising something new in material or a different type of treatment.[1]

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[1]Charles J. Dalthrop, "The Adoption of School Textbooks", Industrial Arts and Vocational Education, XCVII (October, 1938), p. 52.

Interest, therefore, might be considered an essential part of a good title.

The size of a book has much to do with its general use, as well as its durability. A large heavy textbook will not have the convenience of a smaller one of the standard 6" by 9" size and will be less used. In the average high school where hall lockers are used the larger or longer textbooks are hard to fit in and will be thrown into the locker causing undue wear. On the other hand, a book smaller than the standard size is likely to limit the size of the illustrations and is not recommended.

Most textbooks are printed upon white paper with little or no gloss. "Schoolbooks should be printed in black on white paper. Legibility depends upon the contrast between the ink and the paper. To avoid the glare of reflected light the paper should be without gloss."[1] A glossy paper looks nice, but because of eyestrain the reader soon loses interest in the book.

Wide margins rather than narrow ones are recommended because of their tendency to reduce eyestrain. "The margins should be wide enough so that the eye on the backward movement does not swing off the paper."[2] The large textbook with two parallel columns on one page is not desirable. It is impossible to read one column in such a book without some straying of the eyes to the other which causes eye strain. Long lines are also undesirable for the same reason.

The experience and the reputation of the publisher in the field are important items to consider. It may be that publications from companies specializing in the field of industrial arts would have greater worth than

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[1]Hyman Sachs, "Textbook Research", Publisher's Weekly, CXXXIII (June 4, 1942), p. 2283.

[2]Ibid., p. 2283.

would books from those publishers with a wide variety of publications and with little or no experience in the field.

The copyright date and the latest date of revision generally give evidence as to the up-to-dateness of the textbook. These dates may show how much the book is abreast in the most recent instructional materials treated in the book. The recency of publication can easily throw a definite light on the relation between the philosophy of the textbook and prevailing trends. Progressive educational procedures must change from time to time, and these changes must be incorporated into textbooks if the maximum of progress is to be made for the instruction of students.

> A regiment of researchers and experimenters in the psychological laboratories of universities here and abroad have tested and tabulated the ways the mind works. Their statistically indisputable conclusion settles that a large number of heretofore accepted ways of going at a lesson waste time and damage minds.[1]

The reputation and experience of the author is another factor to be considered. Naturally, a textbook written by one who is an accepted authority in his field will be more desirable than a book written by one with a limited experience as an author, as a craftsman, and in the teaching profession.

The preface of a book gives a clue as to the author's purpose in writing the book. It gives the user a definite idea as to what he may expect from the textbook as well as a bird's-eye view of the contents of the book. The following preface illustrates a type which is recommended as desirable:

> The purpose of this book is to supply the need for organized material dealing with the tools and fundamental processes common to many metalworking activities, and with related matter pertaining to the production, characteristics, and manipulation of the common metals.[2]

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[1]William McAndrew, "School Book Famine", Saturday Review of Literature, XV (March, 1940), p. 11.

[2]Edward Berg and Bristol E. Wing, Essentials of Metal-Working, (Peoria: The Manual Arts Press, 1934), p. 3.

Textbooks should be read easily and be interpreted readily by most students within a class. During the past twenty-five years, there has been an increased emphasis upon acquiring technical information in the industrial arts field. Due to the increasing complexity of our industrial society, we can expect this trend to continue.

There are various means of presenting technical information, but perhaps the most commonly used is that of the textbook. Since the textbook is widely accepted, it is important that it be efficiently structured, not only in accuracy and completeness of its content, but also with regard to the readability of its content.

> Readability refers to the sum total of these elements within a given piece of printed material that determines the extent to which a group of readers understand it and read it at an optimum speed.[1]

Many teachers of industrial arts are aware that some of their students do not read textbooks with understanding. As a result, some teachers have largely disregarded technical and related information in published form and resorted to manipulative activity with only slight attention to the informational content of industrial arts.

If the textbook is to continue as an important part of the instructional program in industrial arts, it must be readable. It must be a book that most students within a class are able to read easily and interpret readily. Authors and publishers of textbooks in the various areas of industrial arts should certainly be aware of the factors of readability and control such factors so that their textbooks might be closer to the reading availability of the majority of students who will use them.

The subject matter of a textbook should be organized in an understandable sequence and should be presented through problems that are modern

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[1]W. R. Miller, "How Readable are Industrial Arts Textbooks", The Industrial Arts Teacher, (September-October, 1961).

and up-to-date. The fundamental principles and the fund of information furnished by the text should be given in direct connection with those principles or projects which illustrate concretely such principles and information. The material should be so presented as to encourage constructive and independent thinking which will arouse curiosity and challenge investigation on the part of the student and inspire work.

A good table of contents is economical of the user's time, enabling one to locate quickly the desired information. Hence, this item is recommended as being worthy of consideration in evaluating a text.

> Detailed tables of contents to run in the front of the book serve a useful purpose. When the chapter headings with the outstanding subheadings listed underneath are selected carefully, they give a quick but comprehensive picture of the contents.[1]

A textbook should be suitable to the grade or group level where it is to be used. To prepare a book for high-school pupils the same vocabulary and phrasing should not be used as would be found in a text used in a college. There should not be frequent long involved sentences.

> Long sentences often convey a rather indistinct meaning, and leave the reader, especially one of high school age, with a hazy idea of what he has read. A good text should possess short sentences that are so worded as to be easily understood. All statements should be concise and accurate, with faultless grammatical construction.[2]

Hence, the textbook should be chosen by one who is familiar with the interests, activities, and needs of the particular group who will make use of the book.

Books selected for texts and for reference should offer a contribution to the locality where the book is to be used. Communities and schools vary in their interests, needs, and requirements. The rural high-school

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[1]McGraw-Hill Book Company, Suggestions to the McGraw-Hill Authors (New York: McGraw-Hill Book Co., 1940), p. 6.

[2]Alfred L. Hall-Quest, op. cit. p. 84.

locality with agriculture as the most important industry might require different textbooks and related information from that needed in a high school found in a city of 50,000 people with industrial interests.

> The arrangement of materials of instruction is an integral part of the process of adapting courses of study to local conditions . . . Special consideration needs to be given to the problem of selection and use of local materials.[1]

The importance of illustrations in reading material cannot be over-emphasized. Hall-Quest says:

> One picture will mean more than many words. Charts, tables, and diagrams are indispensable, provided they are properly explained by the author. When properly constructed such illustrations are of inestimable value in providing clear and accurate perception.[2]

In respect to the specific contribution of illustrations to industrial-arts textbooks:

> Constructions and fundamental operations should be well illustrated . . . A drawing should be so nearly perfect as to present clearly and accurately the facts of the construction or operation.[3]

Hence, illustrations should be accurate in every detail, and the size should be such as to make them easily understood, self-explanatory, and interesting.

A textbook should contain a sufficient number of references to satisfy the reading needs of good students. The use of related information can add much to industrial arts courses through acquainting the pupil with problems of industry, methods of processing raw products, optional jobs or projects, and occupational information.

> A textbook should serve as a guide to interesting side trips or to points of special interest along the way . . . The textbook so

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[1]Alfred L. Hall-Quest, op. cit., p. 84.

[2]Alfred L. Hall-Quest, op. cit., p. 139.

[3]Samuel J. Vaughn and Arthur B. Mays, Content and Method of the Industrial Arts (New York: The Century Co., 1924), pp. 138-140.

> used becomes not a dead paper education, but training for immediate as well as for future ends.[1]

A well-constructed index is highly desirable in a textbook. By using an index the pupil is enabled to locate quickly information for which he has a need. Publishers consider a good index is one essential part of a textbook and advise authors to include it in their books.

> A good index is necessary in all technical work. A good index is one which enables the reader or student to locate readily the item which he seeks.[2]

The item of cost is worthy of consideration in selecting textbooks. In those communities where pupils are expected to furnish their own textbooks the selection of lower-priced textbooks usually meets with the approval of the parents of the students. Especially for this reason, lower-priced textbooks, if equally valuable in other respects, are recommended in preference to more expensive ones. Local conditions should be considered always by the one who is entrusted with the selection of textbooks.

The preceding criteria may constitute the usual basis of rating industrial-arts textbooks by both teachers and supervisors. No attempt will be made to rate the chosen four textbooks using the general criteria of physical features. Moreover, the evaluation of a textbook in the light of these features would not give the user any idea either of the quality or of the quantity of contents contained within the book. Erickson recognized these two values in a textbook when he said:

> Industrial arts textbooks should have detailed explanations covering the fundamental mechanical operations, as well as information that has bearing on the subject as a whole, rather than the construction of articles and projects. The mission of books of this kind is to treat the tool processes, and for attaining skill in the handling of tools.

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[1]Alfred L. Hall-Quest, op. cit., p. 165.

[2]McGraw-Hill Book Co., op. cit., p. 7.

> They also treat related and technical information pertaining to the subject.[1]

To meet this need, specific criteria for analyzing selected areas of student development, such as manipulative techniques and subject-matter information will be applied in the next chapter.

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[1]Emanuel E. Ericson, op. cit., p. 149.

CRITERIA RELATING TO THE CONTENT OF AN INDUSTRIAL ARTS TEXTBOOK

To evaluate content in the textbooks of the industrial arts field one must determine the areas of student development in teaching his subject. The following are presented as objectives of the industrial-arts program:[1]

1. To develop in the student manipulative skill in the use of tools, machines, and equipment. These skills will be of great value in industry and in maintenance at home.

2. To develop in the student a knowledge of subject-matter information relative to materials, products, processes, and techniques of the trades and of industry. This could help to make students more competent to choose future work.

3. To develop in the students desirable habits, traits, and attitudes of life and living. The common cry against young people who go to work is that they have no established mature work habits acceptable to business or industry; that is, the feeling of responsibility, ability to plan and to execute work independently and in cooperation with others. The industrial arts laboratory is probably the best place in school for the development of such habits. With conscious planning under which the student is in a similar position to a workman on a job, these qualities can be obtained to a great degree.

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[1] Subject Field Series, Bulletin D-6, (Illinois Curriculum Program, State of Illinois, Springfield).

4. To develop in each student an appreciation and use of industrial products and processes. Appreciation of good design and of good workmanship can be attained to a considerable degree in the school laboratory. Basic principles and attitudes can be established leading towards continued investigation and study. As to use, one realizes that machines, mechanical devices, and appliances are increasing at a rapid rate. Every person's well being is dependent daily upon their use. Some first-hand experience will enable a person to solve better the problems that pertain to the purchase and use of mechanical products of industry.

5. To develop in each student habits of health and safety for self and others as related to tool and machine use. Good health and safety habits should be emphasized above everything else not only to reduce the accident rate but to maintain healthful surroundings in the school shop. Not only should safety and health instruction be stressed in regard to the use of tools, machine, and materials, but the instruction could be carried over to the use of cars, home appliances, electrical equipment, and many other hazards in and around the home.

Textbooks give very little information in respect to the areas of habits, traits, attitudes, appreciation, and use. Whether these objectives are attained will depend upon the leadership and inspiration of the classroom teacher. On the other hand, one can evaluate to an extent the manipulative techniques and the subject-matter information found in industrial-arts textbooks. In this study, rating the quantity of instructional material covering specific manipulative techniques and subject-matter information as found in four general metal textbooks was the chief concern. The course of study for general metal in the proposed bulletin, "Guide Lines for Industrial Arts Teachers"[1] was used as a standard.

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[1]Subject Field Series, Bulletin D-6, op. cit.

A rating scale was devised for the two areas of development previously mentioned covering a year's work in general metal. The rating scale is divided on the right side into three columns which are labeled good, medium, and poor. Each column is divided into four sections, one for each book that is being rated. On the left side of the scale are listed the areas of development, manipulative techniques and subject-matter information, that are being rated. Each book is then studied for the presence or absence of the particular process or information designated in the scale. A cross is placed in the appropriate book column (1, 2, 3, or 4) if the item appears in the text. To determine in which column (Good, Medium, or Poor) the crosses are to be placed the following standards were arbitrarily established:

Good: Three-fourths of a page or more of illustrations, figures, and word content.

Medium: One-fourth to three-fourths of a page of illustrations, figures, and word content.

Poor: Less than one-fourth of a page of illustrations, figures, and word content.

As an illustration of the use of the rating scale, four textbooks in metal work have been numbered on the right-hand side of the scale as follows:

1. F. E. Tustison, Metal Work Essentials.
2. John L. Feirer, General Metals.
3. Roland R. Fraser and Earl L. Bedell, General Metal.
4. Oswald A. Ludwig, Metal Work Technology and Practice.

The rating scale is constructed in two major areas following the outline of a general metals course as given in "Guide Lines for Industrial Arts Teachers".[1] The first part consists of the manipulative activities considered desirable and the second part the subject matter to accompany the manipulative activities.

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[1] Subject Field Series, Bulletin D-6, op. cit.

RATING SCALE FOR THE EVALUATION OF GENERAL METAL TEXTBOOKS

I. Manipulative Activities

Activities:	Rating											
	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
I. Planning:												
A. Read a working drawing						x	x	x	x			
B. Follow written and oral directions						x	x		x			x
C. Make out a bill of material							x	x	x	x		
D. Select an appropriate undertaking							x		x	x		x
E. Choose material for the job							x		x	x		x
F. Figure number of pieces							x	x	x	x		
G. Study and follow plan of procedure							x	x	x	x		
II. Safety:												
A. Follow personal organization								x	x	x	x	
B. Housekeeping responsibilities						x			x		x	x
C. Practice guardes and safety devices						x			x		x	x
D. Maintain safety in all tool and machine operations						x	x		x			x
III. Measurement and Layout:												
A. Take off measurement		x			x		x					x
B. Layout measurements	x	x					x					x
C. Layout patterns on stock		x							x		x	x
D. Layout work on a surface plate					x	x	x					x
E. Practice precision measuring instruments		x	x	x			x					

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
F. Transfer measurements to stock		x							x		x	x
G. Practice gages, testing instruments		x	x		x			x				
IV. Properties and Uses of Metal:												
A. Heat treat metals		x	x	x					x			
B. Test hardness of metal						x			x		x	x
C. Experiment with various metals												
V. Bench Tools and Processes:												
A. Metal cutting saws	x	x					x	x				
B. Adjust and maintain	x				x	x	x					
C. Cut sheet, bar, tubing						x	x	x	x			
VI. Holding Tools for Bench Work:												
A. Hold stock in a machinist's vise		x		x	x		x					
B. Hold stock using locking pliers									x	x	x	x
C. Clamp stock using C-clamp				x	x	x					x	
VII. Engine Lathe:												
A. Start, stop, and adjust machine						x	x	x	x			
B. Set up and operate knurl, taper, bore, drill, ream, turn and chase threads		x	x	x					x			
C. Calculate feeds and speeds				x	x	x					x	
VIII. Shaper:												
A. Start, stop, and adjust machine			x			x			x			x
B. Calculate feeds and speeds						x	x		x			x
C. Adjust and position stroke									x	x	x	x
D. Machine a slot, keyway, angles, dovetail						x	x		x			x
E. Clean and maintain machines			x			x			x			x

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
IX. Threads, Taps, and Dies:												
A. Cut internal threads	x			x		x	x					
B. Cut external threads	x	x		x			x					
C. Cut pipe threads	x									x	x	x
D. Set adjustable dies					x	x	x	x				
X. Wrenches:												
A. Tighten and loosen nuts and bolts						x		x	x		x	
B. Hold and turn round stock						x		x	x		x	
XI. Chisels:												
A. Cut light metal using cold chisel					x		x	x		x		
B. Sheer sheet metal					x	x	x	x				
C. Grind chisels					x	x	x	x				
XII. Punches:												
A. Grind prick and center punches						x	x	x	x			
XIII. Files:												
A. Clean and maintain files		x	x		x			x				
B. File metal using different files					x			x			x	x
C. Select proper file	x		x				x	x				
IX. Hand Snips:												
A. Cut sheet metal using various snips	x	x					x	x				
B. Select proper snips for use						x	x	x	x			
X. Pliers:												
A. Perform operation using various pliers					x	x	x					x
XI. Screw Drivers:												
A. Care and maintain screwdrivers						x		x	x		x	

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
B. Drive screws with the various types of heads						x			x		x	x
XII. Hammers and Mallets:												
A. Select proper hammer for the job		x			x			x			x	
B. Perform operations with the various hammers		x					x		x			x
XIII. Flaring Tools:												
A. Practice flaring tubing	x	x		x			x					
B. Abrasives				x	x	x	x					
C. Shappen tools using slip stone									x	x	x	x
D. Grind tools	x									x	x	x
XIV. Milling Machine:												
A. Start, stop and adjust			x			x			x			x
B. Set up and operate						x	x		x			x
C. Calculate feeds and speeds						x			x		x	x
D. Mill angles, irregular surfaces, slots, bore, drill, index						x	x		x			x
XV. Metal Spinning:												
A. Start, stop, and adjust						x	x	x	x			
B. Calculate feeds and speeds		x				x		x	x			
C. Operate machine-spinning, annealing, beading	x	x					x	x				
D. Clean, adjust, and maintain					x	x					x	x
XVI. Grinders:												
A. Start, stop, and adjust	x	x					x	x				
B. Calculate feeds and speeds								x	x	x	x	
C. Operate machine									x	x	x	x

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
D. Clean, maintain				x	x	x	x					
XVII. Drills and Drill Presses:												
A. Start, stop, and adjust machine		x	x					x	x			
B. Set up and operate		x		x			x		x			
C. Drill speeds and speed factors		x					x		x			x
D. Clean, adjust, and maintain									x	x	x	x
XVIII. Sheet metal:												
A. Set up and operate machines for braking		x	x		x			x				
B. Set up and operate machines for forming	x	x	x					x				
C. Form sheet metal seams, locks, edges	x	x					x	x				
D. Layout sheet metal pattern	x	x					x	x				
E. Fasten sheet metal with various fasterners					x	x	x					x
XIX. Metal Fasteners:												
A. Secure metal using screws, bolts, solder, Welding, and rivets	x	x		x			x					
B. Attach gears, pulleys, handwheels, using woodruff keys								x	x	x	x	
C. Secure nuts using lock washers						x	x	x	x			
D. Frabricate projects with metal fasteners		x							x		x	x
XX. Metal Finishes:												
A. Finish metal with abrasive cloth		x						x	x			x
B. Apply finishes with brush, spray, dip		x		x	x		x					
C. Peen metal on anvil						x			x		x	x
D. Finish with steel wool					x	x		x			x	
E. Spot finish using drill press								x	x	x	x	

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XXI. Oxyacetylene Welding:												
A. Set up and adjust equipment									x	x	x	x
B. Clean and maintain equipment						x	x	x	x			
C. Braze, weld, cut						x		x	x		x	
XXII. Arc Welding:												
A. Set up, adjust, and operate equipment						x	x		x			x
B. Strike an arc, run a bead in all positions		x					x		x			x
C. Test welds									x	x	x	x
D. Cut with an arc									x	x	x	x
E. Run lap weld, T-fillet, outside corner, butt weld, V-butt weld						x			x		x	x
F. Clean and maintain equipment									x	x	x	x
XXIII. Art Metal:												
A. Layout design on metal			x		x	x		x				
B. Apply finishes to metal		x						x	x		x	
C. Form and shape metal	x	x	x					x				
D. Finish with brush, spray, dip		x						x	x		x	
E. Assemble with fasteners		x			x			x			x	
F. Etch, saw and pierce metal		x							x		x	x
XXIV. Foundry:												
A. Condition sand					x	x	x	x				
B. Take off a melt									x	x	x	x
C. Shake out a mold	x	x	x					x				
D. Clean a casting						x	x	x	x			

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XXV. Heat Treating:												
A. Harden steel						x	x	x	x			
B. Test hardness of metal						x		x	x			x
C. Draw temper, anneal, normalize, carbonize, quench metal				x		x	x		x			
XXVI. Forging:												
A. Heat metal using gas furnace		x						x	x		x	
B. Remove hot stock from furnace		x						x	x		x	
C. Cut metal with hot and cold hardy						x		x	x		x	
D. Draw out metal by hot forging						x		x	x		x	
E. Safety precautions in forging									x	x	x	x
XXVII. Portable Hand Tools:												
A. Set up, adjust, and operate hand tools	x	x		x			x					
B. Drill, sheer, saw, grind, polish and buff hand tools	x	x		x			x					
XXVIII. Care and Maintanance:												
A. Clean and oil machines				x					x	x	x	
B. Adjust and maintain tools and machines		x	x						x			x
C. Sharpen cutters and cutting edge tools		x	x						x			x

II. Subject Matter Information

Information:

	Rating											
	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
I. Planning:												
A. Organization of the course									x	x	x	x
B. Class organization												
C. Working drawings, blueprints, alphabet of lines, shape description, scale, abbreviations, material symbols, dimensions, bill of material						x	x	x	x			
D. Plan of procedure							x		x	x		x
E. Material conservation-stock layout									x	x	x	x
F. Safety principles-rules and regulations						x	x	x	x			
G. Principles of design and construction								x	x	x	x	
II. Safety:												
A. Class and personal organization						x			x		x	x
B. General safety-self and others								x	x	x	x	
C. Conduct shop rules and regulations							x		x	x		x
D. Safety devices, guards, appropriate dress						x			x		x	x
E. First aid treatment									x	x	x	x
F. Physical facilities-lighting, heating, ventilation, electricity									x	x	x	x

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
G. Shop house keeping-personal belongings, tools and materials, project storage oily rags, scrap, waste, liquid containers						x			x		x	x
III. Measurement and Layout:												
A. Semi-precision measuring tools, rules, squares, protractors, calipers, dividers, gages	x	x	x	x								
B. Layout tools-surface plate, scriber, prick punch, center punch, C-clamp, V-block					x	x	x	x				
C. Precision tools-micrometers, vernier calper, vernier protractor, indicators, hardness testers		x	x	x					x			
D. Geometry of layout formulas						x			x		x	x
E. Tool techniques, cost, care, quantity, safety	x									x	x	x
IV. Properties and Uses of Metal:												
A. Ferrous metals, mining, processing, refining, production, mechanical, shaping, composition, fabrication	x	x	x	x								
B. Non-ferrous metals-mining, processing, refining, production, mechanical shaping, plating, and plating methods, compounds	x	x		x			x					
C. Physical properties, hardness, tensile strength, elasticity, malleability, fatigue resistance, treatability	x	x									x	x
D. Employment opportunities, safety in working with metals, products, use, cost				x					x	x	x	
V. Metal Working Occupations:												
A. Trade and industrial occupations								x	x	x	x	
B. Working conditions, hours, wages, training and education, future prospects								x	x	x	x	

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
VI. Bench Tools and Processes:												
A. Metal cutting saws, kind, cost, quality, blade length, points or pitch, speed and presure, cutting stroke, hard and soft backs, tool techniques	x	x					x	x				
B. Safety and safe practices	x					x	x	x				
VI. Threads, Taps, and Dies:												
A. Kind and cost, quality	x					x	x	x				
B. Threads, R. H. and L. H., parts of a thread, pitch and lead, thread fits, kinds		x			x		x	x				
C. Taps--R. H. and L. H. solid, round, adjustable				x	x	x	x					
D. Dies--R. H. and L. H. solid, round, adjustable				x	x	x	x					
E. Equipment--die stocks, tap drills, tap wrench, pipe, burring reamers, cutting lubricants		x	x		x			x				
F. Tool techniques, safety and cost factors	x			x			x			x		
VII. Wrenches:												
A. Adjustable--monkey, vise grips, end, and chain pipe				x	x	x					x	
B. Non-adjustable open end, box, socket, spanner, single and double open end, offset, ratchet						x		x	x		x	
C. Selection, sizes, use, cost, safe use		x		x					x		x	
VIII. Chisels:												
A. Sizes, care, use, cost												
B. Kinds--blacksmith, flat, cape, diamond point, round nose		x			x		x	x				
C. Safe practices, tool techniques, operations		x			x		x	x				

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
IX. Punches:												
A. Sizes, care, use, and cost					x			x		x	x	
B. Kinds--blacksmith, prick, center, drift, hand, hollow, solid, and pin	x		x	x		x						
C. Tools techniques, safe use					x	x	x	x				
X. Files:												
A. Kinds, size, cost, quality, care					x	x	x	x				
B. Indentify characteristics, shape, length, cut, spacing between teeth				x	x	x	x					
C. Tool techniques--cutting procedures, safe practices	x			x		x	x					
XI. Hand Snips:												
A. Selection, care, use, cost					x	x					x	x
B. Kinds--double-cutting, slitting, hawks bill, aviation, straight, combination, bull dog, compound lever, circle, trojan				x	x	x	x					
C. Tool techniques--cutting procedures, safe practices, limitations						x		x	x		x	
XII. Pliers:												
A. Side cutting, needle nose, slip joint, flat round nose, channel lock			x			x			x			x
B. Use, cost, quality, size, proper selection and care, safety									x	x	x	x
XIII. Screw Drivers:												
A. Machinist's, phillips, offset, ratchet, round blade, square blade				x		x			x			x
B. Safety and safe practices								x	x	x	x	
C. Selection, care, use, cost						x		x	x		x	

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XIV. Hammers and Mallets:												
A. Machinist's riviting, cross peen, chipping, setting, raising, planishing, blacksmith	x	x		x			x					
B. Mallets--wood, rawhide, plastic, rubber, metal						x		x	x		x	
C. Selection, care, use, cost, quality, safety	x			x		x					x	
XV. Flaring Tools:												
A. Selection, care, use, cost					x		x			x		x
B. Safety tool techniques					x	x					x	x
C. Abrasive--natural, artificial		x			x		x	x				
D. Grain size, loose grain cloth type, coating methods, backing material		x			x		x	x				
E. Safety and safe practices					x	x					x	x
XVI. Holding Tools for Bench Work:												
A. Bench vise, locking pliers, tool makers clamp, parallels, angle iron, C-clamp, V-block, drill press vise, machinist's vise	x	x		x			x					
B. Selection, care, use, cost, quality, safety				x					x	x	x	
XVII. Engine Lathe:												
A. Kinds and major parts--bed, headstock, tailstock carriage		x					x		x	x		
B. Setup and operate--start, stop, adjust, drilling, facing, screw threads			x	x		x			x			
C. Tool bite--mounting, grinding, setting			x	x		x			x			
D. Safety factors									x	x	x	x

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XVIII. Shaper:												
A. Kinds and major parts--column, base, table, ram, tool head						x	x		x			x
B. Start, stop, and adjust machine						x	x		x			x
C. Cutting tools and shaper operation						x	x		x			x
D. Parts, size, quality, cost						x	x		x			x
XIX. Milling Machine:												
A. Major parts, operations--cutters, plain, side, slitting, angular, slab, inserted tooth, gear tooth, woodruff key set, concave, convex						x	x		x			x
B. Calculate feeds and speeds									x	x	x	x
XX. Metal Spinning:												
A. Principle kinds and parts						x	x		x			x
B. Operation procedure			x			x			x			x
C. Spinning tools and work performed						x	x	x	x			
D. Metals adapable to spinning			x			x		x	x			
E. Kinds, sizes, parts, quality, cost, safety				x		x	x		x			
XXI. Grinders:												
A. Bench, pedestal, surface					x	x	x	x				
B. Surface grinder--principles and procedures									x	x	x	x
C. Speeds and feeds								x	x	x	x	
D. Grinding wheels--kinds, grades, shapes	x					x	x					x
E. Sizes, cost, quality							x		x	x		x
F. Safety and safe practices					x	x	x	x				

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XXII. Drills and Drill Presses:												
A. Drilling machines--hand, portable, sensitive, back geared, gang, radical		x	x	x					x			
B. Feeds and speeds						x	x		x			x
C. Operations--drilling, reaming, countersinking, counterboring, spotfacing, tapping, spotfinishing		x	x	x					x			
D. Holding devices--strap clamp, step blocks, parellels, V-block, angle clamps				x		x	x		x			
E. Selection, use, care				x		x	x		x			
F. Safety regulations and precaution									x	x	x	x
XXIII. Sheet Metal:												
A. Layout and layout operations, layout tools	x	x					x	x				
B. Sheet metal operations--layout, edges, seams, hems, notches, locks	x	x					x	x				
C. Assembly tools, fasteners		x			x		x					x
D. Sheet metal machines--barfolder, hand brake, beading machine, crimping machine, ring and circle shear, turning machines, burring machines, cornice breakes, box and pan brake, grooving machine	x	x	x	x								
E. Kinds of machines--cost, use, quality									x	x	x	x
XXIV. Metal Fasteners:												
A. Bolts--carriage, toggle, stove, machine, tap, stud		x		x	x		x					
B. Screws--machine, cap, wood, leg thumb, set, sheet metal		x		x	x		x					
C. Welding-forge, acetylene, electric, stop, fusion brazing, soldering				x	x	x	x					

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
D. Rivets--flat, countersunk, truss round or bottom, cone, steeple									x	x	x	x
E. Selection, care, use, cost, quality									x	x	x	x
XXV. Metal Finishes:												
A. Antique, hammered, spot, burnishing, electroplating, polishing, painted, lacquered, flocked, blued, bright, wax, enamel				x	x	x					x	
B. Application--spraying, brushing, dipping					x	x	x	x				
C. Selection, care, cost, quality		x							x		x	x
D. Safety					x						x	x
XXVI. Oxyacetylene Welding:												
A. Generator, acetylane tank, oxygen tank						x	x	x	x			
B. Types of welds, rods, fluxes, flame adjustment, heat, types of blow pipes						x			x		x	x
C. Welding techniques, safety						x	x	x	x			
D. Selection, care, cost, quality									x	x	x	x
XXVII. Arc Welding:												
A. Welding and equipment, D.C.and A.C. welders, amperages and voltages, polarity		x					x		x			x
B. Inert gas arc welding									x	x	x	x
C. Electrodes, arc length						x			x		x	x
D. Carbon arc welding									x	x	x	x
E. Selection, size, cost, and quality						x			x		x	x
F. Safety precautions.						x			x		x	x

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
XXVIII. Art Metal:												
A. Tools and equipment	x	x					x	x				
B. Tool operations--hammering and peening, raising, annealing, planishing, fluting, chasing, finishing, tapping, design, stamping, sawing and piercing, pickling, sinking, forming, and shaping	x	x	x	x								
C. Finish and decoration		x						x	x		x	
D. Ornamental iron and wrought iron									x	x	x	x
E. Fastening and fasteners									x	x	x	x
F. Cutting, forming, bending, spinning			x					x	x	x		
G. Selection, cost, care, quality, safety									x	x	x	x
XXIX. Foundry:												
A. Terminology, metals used, tools			x		x	x		x				
B. Types of patterns, molding sand, pressures					x	x	x	x				
C. Selection, products, use, cost, quality			x	x		x			x			
D. Safe practices in foundry operation			x	x	x					x		
XXX. Forging:												
A. Bending, drawing, forming, forge welding						x		x	x		x	
B. Forging equipment--tools and materials				x		x			x		x	
C. Forging processes--cutting, drawing, offsetting, bending, scrolls, spirals, twists, upsetting, forge welding		x		x					x		x	

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
D. Selection of equipment, size, cost products				x	x				x		x	
XXXI. Portable Hand Tools:												
A. Electric drill		x			x		x	x				
B. Saber saw								x	x	x	x	
C. Belt sanders									x	x	x	x
D. Disk sander									x	x	x	x
E. Buffers		x	x					x	x			
F. Grinders			x	x	x	x						
XXXII. Heat Treating:												
A. Temperatures, carbon content, cooling or quenching						x	x	x	x			
B. Critical temperature--tempering annealing, normalizing, case hardening						x	x	x	x			
C. Testing metals--Brinnell, Rockwell, Silverscope						x		x	x		x	
D. Selection of metals, use, cost, products									x	x	x	x
E. Safety precautions									x	x	x	x
XXXIII. Care and Maintenance:												
A. Lubricants--gasoline, kerosene, naptha, lubrication oils, cylinder oils, parrafin, graphite white lead									x	x	x	x
B. Animal oils, vegetable oils, cutting oils and compounds								x	x	x	x	
C. Lubricating machinery		x						x	x		x	
D. Bolt and gear drives									x	x	x	x
E. Adjusting machine drives						x	x	x	x			

	Good				Medium				Poor			
	1	2	3	4	1	2	3	4	1	2	3	4
F. Electricity and electrical equipment		x	x					x	x			
G. Grinders and grinding equipment		x	x						x			x
H. Cutting edge tools									x	x	x	x

SUMMARY OF RATINGS

Books Rated	Total Number of Crosses					
	Manipulative Activity			Subject Matter		
	G	M	P	G	M	P
Metal Work Essentials by F. E. Tustison Ray F. Kranzusch	19	22	77	22	28	98
General Metal by John L. Feirer	41	54	27	36	65	50
General Metal by Roland R. Fraser Earl L. Bedell	19	51	50	22	55	73
Metalwork Technology and Practice by Oswald A. Ludwig	17	54	48	39	52	60

Feirer's book ranked high because it covered well most of the manipulative processes and the subject matter units found in the course of study as written for the new Industrial Arts Bulletin for Illinois.

Key: G--Good M--Medium P--Poor

GENERAL SUMMARY

In this study on a suggested method for selecting industrial-arts textbooks based on quantity of content, the following observations and conclusions are listed:

1. In former years, only the general criteria or physical features were used to rate textbooks.
2. There has been little published regarding rating systems for textbooks based on the content of the books.
3. In this study a rating scale was devised to provide an easy tabulation for the quantity of the contents of each book.
4. The rating scale used is based upon the latest accepted standards for content of industrial arts metal work courses. It can be modified as needed when standards change.
5. Similar rating scales can be divided for the other commonly accepted industrial arts subjects.
6. Use of the proposed rating scale for comparison of similar texts or reference books will provide a measurement of subject matter content not usually included in presently accepted criteria.
7. It was noted that the more recently published textbooks received a higher rating in manipulative techniques and subject-matter information than an older text. It, therefore, appears that industrial-arts textbooks are beginning to have more specific technical material to meet these two objectives.

8. This study made no attempt to evaluate the quality of the content.
9. The quality of content in a textbook is no assurance that the teaching units are adequately presented.

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THE APPENDIX

THE APPENDIX

The appendix is arranged in two major divisions following the outline of a general metals course of study. The first part consists of the manipulative activities considered desirable for teaching and the second part the subject matter information. The student is expected to learn the information. The purpose of the appendix is to indicate on what page or pages the above materials can be located in each of the four textbooks.

RELATED RESEARCH MATERIALS

Manipulative Activity	Tustison	Feirer	Fraser	Ludwig
Planning:				
Read a working drawing		23	7	27
Follow written and oral directions		23	15	
Make out a bill of material			15	35
Select an appropriate undertaking			6	
Choose material for the job			10	32
Figure number of pieces			15	32
Study and follow plan of procedure			15	
Safety:				
Follow personal organization				23
Housekeeping responsibilities			10	
Practice guards and safety devices			6	
Maintain safety devices on machinery			6	6
Practice safety in all tool and machine operations				5
Measurement and Layout:				
Take off measurements	7	44-45	22	51
Layout measurements	7-8	44-45	20	
Layout patterns on stock	9	51	28	

	Tustison	Feirer	Fraser	Ludwig
Layout work on surface plate				37
Practice precision measurements		44-46	20-23	
Transfer measurement to stock		44-46		65
Practice gages, testing instruments		49		65
Properties and Use of Metal:				
Heat treatment of metals		225-233	125-128	297-299
Test hardness of metal		229		
Experiment with various metals				
Bench Tools and Processes:				
Metal cutting saws	77-78	61-62	30	73
Adjust and maintain	78-79	62	30	74
Cut sheet, bar, tubing	79	62	31	75
Threads, Taps, and Dies				
Cut internal threads	131-135	113	44	209-213
Cut external threads	136-139	114-115	45	205-207
Cut pipe threads	140-144			
Set adjustible die	140	115	45	205
Wrenches:				
Tighten and loosen nuts and bolts		121		226
Hold and turn round stock		121		227
Chisels:				
Cut light metal using cold chisel	81		35	86

	Tustison	Feirer	Fraser	Ludwig
Shear sheet metal	83	66	35	86
Grind chisels	80	65	33	84
Punches:				
Grind prick and center punch		53	151	38
Files:				
Clean and maintain files	90	85-86	41-42	98
File metal using different files	89			93
Select proper file	87-88	83	37-39	91
Hand Snips:				
Cut sheet metal using various snips	14-16	135-136	36	257
Select proper snips for use		135	36	256
Pliers:				
Perform operations using various plier	86	121	223	
Screw Drivers:				
Care and maintence for screw drivers		109		224
Drive screws with the various types		109		
Hammers and Mallets:				
Select proper hammer for the job	73	102-53		267
Perform operations with the various hammers	73-76	102-103	97	
Flaring Tools:				
Practice flaring tubing				

	Tustison	Feirer	Fraser	Ludwig
Abrasives	93-94	104-105	85	103-105
Sharpen tools using slip stone				
Grind tools	93-94			
Holding Tools for Bench Work:				
Hold stock in a machinist's vise	83	52-53	119	221-245
Hold stock using locking pliers				
Clamp stock using C-clamp	34	74		180, 181 222
Engine Lathe:				
Start, stop, adjust machine		280	160	364
Set up and operate--Knurl, taper, bore, drill, ream, turn, chase threads		284-292	159-171	364-372
Calculate feeds and speeds		283		362-363
Shaper:				
Start, stop, and adjust machine		300	172-173	
Calculate feeds and speeds		301	173	
Adjust and position strokes		300	173	
Machine a slot, keyway, angles, dove-tail, clean and maintain machine		303	176-180	
Milling Machine:				
Start, stop, and adjust		306	185-186	
Set up and operate		307	186	
Calculate feeds and speeds		307		
Mill angles, irregular surfaces, slots bore, drill, index		312	181	

	Tustison	Feirer	Fraser	Ludwig
Metal Spinning:				
Start, stop, and adjust		212	105	373
Set up and operate		212	108-109	374
Operations--spinning, annealing, bending		212-213	110-118	374
Clean, adjust, and maintain		212		
Grinders:				
Manipulative Activity:				
Start, stop and adjust	94-95	108-109	143	328
Calculate feeds and speeds				325
Operate machine	95	109	144	327
Drills and Drill Presses:				
Start, stop, and adjust machine		75-76	152-153	175
Set up and operate		77-78	153	175
Drilling speeds and speed factors		74-75	152	
Clean, adjust and maintain				
Sheet Metal:				
Set up operate machine for breaking	34	146-148	64-65	261
Set up and operate machine for forming	36-40	149-152	56-57	262
Form sheet metal seams, locks, edges	41-49	152-153	62	259
Layout sheet metal patterns	46-47	130-134	62	254
Fasten sheet metal with various fasteners	62	165	73	

	Tustison	Feirer	Fraser	Ludwig
Metal Fasteners:				
Secure metal using screws, bolts, solder		117-120	13	235-237
Bolts, welding, and rivets	62,132	117-120	13	235-237
Attach gears, pulleys, handwheels, using woodruff keys				240
Secure rivets using lock washers		119	13	239
Fabricate project with metal fasteners		117-118		
Metal Finishes:				
Finish metal with abrasive cloth	103	104-105		339
Apply finish with brush, spray, dip	105	123-125	91	340-341
Peen metal on anvil	101	102		
Finish with steel wool	103	124		339
Spot finish using drill press				342
Oxyacetyline Welding:				
Set up and adjust equipment		253	80	279
Clean and maintain equipment				
Braze, weld, cut		259		279
Arc Welding:				
Set up, adjust, and operate equipment		260	83	
Strike an arc, run a bead in all positions		262-265	84	
Test welds				
Cut with an arc				
Run lap weld, T-fillet, outside corner, but weld, V-butt weld		265		

	Tustison	Feirer	Fraser	Ludwig
Art Metal:				
Layout design on metal	73	177	49-50	267
Apply finishes to metal	76	173-174		267
Form and shape metal	74-75	177-180	51-55	268
Finish with brush, spray, dip	76	173-174		267
Assemble with fasteners				
Etch, saw, and pierce metal		183-184		
Foundry:				
Manipulative Activity:				
Condition sand	150	240	132	304
Take off a melt	151-154		136-139	304-309
Shake out a mold	151-154	243-247	136-139	313
Clean a casting		248	140	313
Forging:				
Heat metal using gas furnace		218-224		283
Remove hot stock from furnace		218-221		289
Cut metal with hot and cold hardy		220		286
Draw out metal by hot forging		221		285
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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Safety and safety devices	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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	Tustison	Feirer	Fraser	Ludwig
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