AREAS CONSIDERED AND METHODS OF MEASUREMENT AND EVALUATION OF
STUDENT ACHIEVEMENT IN WOODWORKING USED BY
MONTANA INDUSTRIAL ARTS TEACHERS

BY
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ACKNOWLEDGEMENT

The writer wishes to thank Dr. John Picton for all his time and assistance in writing this paper.
CHAPTER II
REVIEW OF LITERATURE

The review of literature was a means used in attempting to determine
(1) the objectives of the industrial arts program, (2) the methods of
measurement, and (3) evaluation used in the instruction of industrial arts.
Available literature revealed various objectives considered by authorities
in the field of industrial arts.

Objectives of Industrial Arts

If one is going to measure and evaluate a student's achievement, he
should first have in mind a set of objectives for the subject matter taught.
Objectives are definite, predetermined statements of what the desired out-
comes of instruction are to be. Objectives also form a basis upon which a
choice of subject matter can be made.

When measurement and evaluation are to take place, the desired out-
comes in relation to the specific objectives of industrial arts should be
taken into consideration. A study of specific objectives was felt necessary
in determining what the desired outcomes of industrial arts should be.

Wilber,\(^1\) in his book *Industrial Arts in General Education*, states
that each subject taught should have its own specific objectives and state-
ments of values to be achieved, and these should be in keeping with the aims
of general education. He further says that if objectives are to be defensible,
there should be a definite relationship to the objectives of general education.\(^2\)

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\(^1\)Wilber, Gordon O., *Industrial Arts in General Education*, Second

\(^2\)Ibid., p. 43.
writer thought should be covered. The questionnaire was administered to three instructors in the field of industrial arts to determine its validity.

Limitations

This study was concerned with areas considered and methods of measuring and evaluating student achievement in woodworking used by 67 Montana industrial arts teachers as indicated by responses to questions included in the questionnaire and opinions added by teachers returning the questionnaire.

Definitions

Because of the confusion often created by the use of the terms measurement and evaluation, it was felt that a definition as to how these terms would be used throughout the paper should be included. Measurement implies a precise, quantitative value which can be placed on an outcome of instruction, such as a student receiving so many points on a particular test. The term measurement will then be used to signify that part of evaluation dealing with tests and their construction and use throughout the paper. Evaluation, being a more comprehensive term, includes values which result from the exercise of judgment and more subjective appraisals of student achievement, as well as strictly objective techniques. Evaluation will also be used in the sense of grades given students.

The review of literature, outlining short summaries of the (1) objectives of industrial arts, (2) methods of measurement, and (3) methods of evaluation used in the instructional program of industrial arts are presented in the next section.
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The purpose of this investigation was to determine the areas considered and methods used by Montana industrial arts teachers to measure and evaluate skills and related information in woodworking.

A review of literature was made to obtain information concerning methods of measurement and evaluation in industrial arts and to determine that authorities in industrial arts have thought necessary to measure. A questionnaire was developed and utilized to determine what and how Montana industrial arts teachers measure and evaluate students. The investigation was limited to the areas considered and methods of measurement and evaluation used by Montana industrial arts teachers in woodworking.

It was generally agreed upon by authorities in the field of industrial arts that the objectives of the industrial arts program should be the basis for a program of measurement and evaluation. Measurement and evaluation should take in all learning experiences. Several methods of evaluation should be used and many factors should be considered in a marking system.

The teachers returning the questionnaire were in agreement as to the areas which should be considered in an industrial arts program. These areas were knowledge of hand and power tools, general safety, use of hand tools, use of machines, and related information. There was wide agreement as far as qualities to be considered in evaluation of students. There was a wide range as to that part each item in project evaluation should be considered. There was general agreement by industrial arts teachers that the project should be considered part of the final grade. Disagreement among teachers as to systems used in determining final grades were also evident.

It is recommended that industrial arts teachers keep in mind the objectives of their course in determining that and how they will measure and evaluate students. It is also recommended that they determine qualities to consider in student evaluation. It is finally recommended that the teacher of industrial arts woodworking agree as to the importance of a project in a final grade and the weight each part of the project construction should be given in the final grade.
CHAPTER I

INTRODUCTION

More than two thousand years ago written examinations appeared in China. Prior to that time, measurement of a student's abilities was entirely by oral examination. The lack of reliability or oral questioning prompted the search for better and more reliable methods of testing. From the search for better tests came modern methods of evaluating abilities and achievements of students.

Today the most widely used method of measurement and evaluation is through the use of written examinations. It is the writer's opinion that to evaluate students accurately, each teacher should be able to understand the methods of measurement and evaluation in his respective field.

In industrial arts the teacher is faced with somewhat different problems in measurement and evaluation than are teachers of academic subjects. Industrial arts teachers are criticized for having students make things without being too concerned as to the learning taking place as stated by Michaels and Karner:

Frequently shop teachers are criticized, and justly so, on the basis that they merely have students "make things." The project should be considered a means to an end... The project serves as a vehicle of instruction. It becomes a problem which tends to aid students in organizing and integrating their experiences as they direct their efforts towards its solutions.²

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Measurement and evaluation of industrial arts skills and concepts are important aspects in teaching industrial arts. In order to choose or construct tests which give a valid measure of students' knowledge and skills, the industrial arts teacher must first know the objectives of the course.

As in any other subject taught in high school, the methods of measurement and evaluation in industrial arts education have to be exacting in order to measure industrial arts students' knowledge of the subject.

The writer's belief that there were many means of measurement and evaluation used by Montana industrial arts teachers in woodworking and the desire to find out what they were lead to this study.

The Problem

The specific problem in this study was to determine the areas considered and the methods used by Montana industrial arts teachers to measure and evaluate skills and related information in woodworking.

Procedures

To secure information which would make possible a logical solution to the problem, two procedures were used. First, a review of literature was made to obtain information concerning methods of measurement and evaluation in industrial arts and to determine what authorities in industrial arts have thought necessary to measure. Second, a questionnaire was developed and utilized as a means of determining methods of measurement and evaluation used by Montana industrial arts teachers and which areas they considered in evaluation.

The questionnaire was based on a study of literature as to what should be measured and evaluated in industrial arts and included questions which the
Important objectives for industrial arts which are listed in Wilber's book are development of recreational and avocational activities, appreciation for good craftsmanship, consumer knowledge, creative expression, social relationships, safe working habits, skill in a number of basic industrial arts processes, plus provision of an opportunity to know theories and practices of the American industrial civilization and were stated as follows:

1. To explore industrial and American industrial civilization in terms of its organization, raw materials, processes, and operation, products and occupations.

2. To develop recreational and avocational activities in the area of constructive work.

3. To increase an appreciation for good craftsmanship and design, both in the products of modern industry and in artifacts from the material cultures of the past.

4. To increase consumer knowledges to a point where students can select, buy, use, and maintain the products of industry intelligently.

5. To provide information about, and—in so far as possible—experiences in, the basic processes of many industries, in order that students may be more competent to choose a future vocation.

6. To encourage creative expression in terms of industrial materials.

7. To develop desirable social relationships, such as cooperation, tolerance, leadership and followership, and tact.

8. To develop safe working practices.

9. To develop a certain amount of skill in a number of basic industrial processes.³

³Ibid., pp. 42-43.
The objectives which Wilber deems are necessary for a good industrial arts program can be related to those of general education, thus making industrial arts an integral part of a general educational program.

Erickson's "desired goals" or objectives for industrial arts in his book *Teaching the Industrial Arts* self-discovery, self-expression, understanding of industry, appreciation of practical art, consumer knowledge, skill in use of the tools, an understanding of the language of the craftsman, development of good work habits, and development of good safety habits were given as follows:

1. Self-discovery by the pupil of his own abilities and aptitudes, leading toward maturing life interests.
2. Satisfying experience in self-expression through creative effort leading to material accomplishments.
3. Understanding of industrial methods of production, and of the influence of industrial products and services upon the pattern of modern social and economic life.
4. Appreciation of good design and good workmanship in their application to construction and to manufactured products.
5. Judgment and resourcefulness in selection, purchase, use and care of industrial products and services, both in the home and in occupational life.
6. Ability to use tools and materials leading to household maintenance, leisure-time pursuits, and, in some degree, to basic occupational skills.
7. Ability to read and make sketches and drawings used for illustrative and construction purposes, including the ability to read graphic and technical illustrations in books and magazines.
8. Development of maturing work habits, feeling of responsibility, and ability to plan and execute work alone and in cooperation with others.
9. Basic experience in the use of tools, machines, and materials of value in carrying on future educational and professional work on scientific and technological levels.
10. Development of safety habits and fundamental safety consciousness not only in the school but in the home and in future occupational life.4

A two-day conference called by the United States Commissioner of Education Sterling M. McMillin, in 1960, composed of seventeen heads of industrial arts departments came to the conclusion that four objectives of industrial arts should be emphasized. The two-day conference brought out the need to stress the development of students' knowledge of industry, problem solving ability, talents in technical fields, and to develop in each student skill in the use of tools. As stated by the committee the objectives to be stressed are given below:

1. To develop in each student an insight and understanding of industry and its place in our culture.

2. To discover and develop talents of students in the technical fields and applied sciences.

3. To develop technical problem-solving skills related to materials and processes.

4. To develop in each student a measure of skill in the use of the common tools and machines.5

The conference of 1960 further stated that the listing of basic objectives should in no way prevent an educational system from supplementing the four basic objectives. The conference also stated that supplementary objectives should be developed for the various age and grade levels such as elementary, junior high school, senior high school, or adult programs. Also,


supplementary objectives for the gifted and slow learners should be considered. The conference also pointed out that manipulative skills are important, but only as they are used in achieving the major goals of industrial arts education.

Further research as to objectives considered important by other authors revealed that they were very similar to those already listed with only a slight variance. In general, the objectives listed on the preceding pages are the accepted objectives of industrial arts education. The similarity of objectives is further verified by an analysis of objectives proposed by authors in the field of industrial arts and by state and city industrial arts departments. A chart analyzing objectives of industrial arts education between 1928 and 1960 is given below.

From the chart, the following five conclusions were drawn:

1. The objectives consumer knowledge, social habits and attitudes, avocational-recreational and a degree of skill-techniques are considered about as important as they were fifty years ago.

2. There is a tendency to combine related objectives, thus reducing the numbers which are also more nearly unique to industrial arts, such as Florida's recent state bulletin limits its number of objectives to five and Olson's list includes six. Objectives listed by Olson and Florida's recent state bulletin include objectives that are unique to industrial arts.

3. Of the 15 objectives listed in 1928, these eight are included in recent lists of objectives:
   a. exploration;
   b. vocational guidance;
   c. consumer knowledge;
An Analysis of Industrial Arts Objectives Developed Between 1928 and 1960

<table>
<thead>
<tr>
<th>Source of Objectives</th>
<th>Exploration</th>
<th>Educational Guidance</th>
<th>Vocational Guidance</th>
<th>Consumer Knowledge</th>
<th>Handymen</th>
<th>Social Habits and Attitudes</th>
<th>&quot;Pre-Vocational&quot; Purposes</th>
<th>A Degree of Skill—Techniques</th>
<th>Vocational and Non-Vocational Purposes</th>
<th>Safety and Health</th>
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<th>&quot;Pre-Vocational&quot; Training</th>
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d. household mechanics, handyman;
e. social attitudes and habits;
f. avocational-recreational;
g. a degree of skill-techniques; and
h. correlation with other subjects.

4. Several objectives such as "pre-vocational" purposes, satisfies the desire to create, drawing and design, social-economic, cooperation, wholesome personality balance, and inventiveness-ingenuity were rejected in 1923, but were included in recently approved lists. ⁶

Objectives, being definite, predetermined statements of what the desired outcomes of instruction are to be, need to be considered when setting up a measurement and evaluation program. If the measurement and evaluation used by industrial arts teachers is to be of any value, it should be in conjunction with objectives adopted as part of the industrial arts program of instruction.

With definite objectives in mind, various methods of measurement and evaluation are to be considered next.

Measurement of Industrial Arts

Measurement, being that part of evaluation which places a quantitative value upon knowledge, is accomplished by means of testing. The following section will deal with the evolution of tests and their construction and uses.

Evolution of tests. The use of reliable testing programs has been a comparatively recent development. "Prior to 1900 learning was considered

⁶Ibid., p. 18.
largely an intangible substance that could be measured only by the individual teacher on a subjective basis." With the introduction of standardized tests during World War I, student scores were compared with students in all parts of the country. About 1930, new tests of ability and aptitude were developed and evaluative criteria were designed. At the present time there are broad programs of standardized tests and evaluating programs in industrial education which includes intelligence tests, aptitude and prognostic tests, achievement tests, and diagnostic and analytical tests.

The importance of tests in a total educational program cannot be denied. Equally important are the individual tests of measurement of student achievement in industrial arts education.

Ericson mentions the following reasons for establishing a testing program: (1) Tests will help the teacher learn to what extent students are mastering instructional material presented; (2) teachers discover learning difficulties among industrial arts students which could be lack of general scholastic intelligence, lack of previous experience, wrong attitude toward the work, social maladjustment, inadequate instructional materials, or faulty instruction; (3) tests motivate students; (4) tests provide selection and classification of students; (5) tests measure teaching efficiency; (6) tests can be used to re-evaluate course content; (7) tests establish and maintain standards; (8) tests make teaching objective; (9) tests provide

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8 Ibid., p. 303.

9 Ericson, op. cit., p. 139.
a basis for marks and ratings; (10) tests can be used as a basis for guidance; (11) tests serve as a basis for research.

**Test construction.** Having established a need for a testing program, the teacher must then determine whether he will use the tests provided with the text or construct his own tests. Although standardized tests are often provided with the text, the industrial arts teacher may find these tests are not geared to his own objectives.

Should the teacher find the need to construct a test of his own in relation to his objectives, he should keep in mind the following points. The test should be based upon established objectives for the course. It should cover material which has actually been taught. The teacher should select a significant number of test items and use a sufficiently large number of items. Statements used should be brief and the vocabulary used suitable for the age level of the students. No trick questions should be included. Questions used should assure one single response and should call for evidence of understanding of the material being tested. If essay questions are used, questions should be worded so as to make sure the student understands exactly what should be covered in the answer. Good mechanical arrangement should be used and items should be arranged in order of their difficulty. The teacher should omit obvious and self-solving items as these items are no indication of content actually learned. One test item should not depend on another for clarity of meaning or for correct response. When selection of response is involved, care should be taken that all possible responses are as nearly plausible as possible. Teachers should use a variety of types of tests. The teacher should make the physical conditions uniform for each test and all students being tested.
Construction of test items as they are being taught provides more accurate measurement and ease of construction. The teacher should furnish adequate instruction when giving the test as well as using sample items and responses. Identify the test as to date given and subject matter covered. Finally, recheck and improve the test with each use.

In summarizing test construction, "a competent teacher makes certain that his stated objectives are also his test objectives."

To accomplish this, tests should be made up at the same time the objectives of a lesson are determined, and they should be included in instruction. Only by keeping course objectives in mind can tests be constructed that correlate to the objectives.

Types of tests. Having determined a need and explored the construction of a test, the instructor must then consider the types of tests to be used. Since a teacher presumably wants to carry out a suitable program of measurement in his particular area, he should be aware of the various types and techniques used in measurement. Tests that are available include scholastic aptitude, special aptitude, mechanical aptitude, occupational interest inventories, and achievement tests which involve standardized and teacher-made tests.

Possible application of scholastic aptitude or general intelligence tests in industrial arts would be a relationship of scores to probable success in industrial arts. Often, although a student may have only average or below average I.Q., he is able to succeed in industrial arts.


11Ericsson, op. cit., p. 195.
The probable cause for this is the fact that scholastic aptitude tests in general are set up to test areas of so-called academic subjects. The theory that all low I.Q. students will succeed in industrial arts and that high I.Q. students will dislike industrial arts courses has proved to be of little value in the selection of industrial arts students. Although there is the danger of misuse of I.Q. scores, they do have value for the industrial arts teacher's interpretation of behavior in the shop or classroom. Students ranking high in factors such as space, number and reasoning tend to have greater success in industrial arts.\textsuperscript{12}

Another type of test available would be the special aptitude test. This particular test is used to predict probable success in particular areas in the school program or in occupational life. These tests are available for such areas as music, art, language, manual dexterity.\textsuperscript{13}

Achievement tests are designed to measure proficiency or accomplishments in specific tasks or types of work rather than natural aptitudes or degrees of interest. The two general types are the standardized and the teacher-made tests. The standardized achievement tests are tests for which content has been selected and checked carefully and for which norms have been established. There are very few standardized tests available in the field of industrial arts and the ones that are available are not always applicable. The teacher-made or informal achievement tests are used extensively by industrial arts teachers. The validity of a teacher-made test will be high if the teacher has kept the objectives of the course in mind.

\textsuperscript{12}Ibid., p. 196.

\textsuperscript{13}Ibid., p. 198.
while teaching the subject matter and constructing the test.

Types of informal tests that can be prepared by the teacher are objective tests which are usually true or false, multiple choice, completion, matching, procedure arrangement tests, visualization tests, identification tests, and object tests. There are also actual performance tests in the use of tools by the student and tests are observation on the part of the teacher. An example of a performance test would be the squaring up of a block, after which the teacher would check the results for accuracy and while the student is working would observe how the student uses the tools. Performance tests fit into the category of tests which are subjective in nature.

A sound measurement program cannot be developed on purely objective or subjective tests. The teacher must use both methods of testing if the program is to be successful. There are certain strengths and weaknesses in each method which the teacher must be able to determine.

Objective tests are tests containing questions which can be answered with short direct responses, and for which there is only one possible correct answer. Objective tests are usually a true-false, multiple choice, matching or completion type of test. Some of the strengths of an objective test are that it is fairly reliable in that it tests knowledge which the teacher deems necessary to measure, it is very effective in measuring factual information, and it is fairly easy and fast to score.

In comparison, subjective tests are either essay, oral or observation tests. The subjective test has a wide range of possible correct answers and may prove to be biased. The advantages of a subjective test are the depths of insight as to the amount of knowledge the student actually has, and it helps students express themselves through writing while providing a method
of measurement when perhaps no other method is available. The weaknesses of a subjective test are that it lacks reliability because of a teacher’s possible bias in correcting and there is a possibility of misinterpreting test questions by the student, as well as the time consumed in scoring.

In conclusion, test results should not be considered an absolute prediction or evaluation of a student’s probable success. Many factors can cause a student to do poorly during an examination period; such things as personal problems, a common cold, sickness, the need for glasses, room temperature, lighting or distractions in or around the classroom all play an important part in the total result. Tests often do not test a student’s real understanding of a problem because of poor test construction will not be a true indication of a student’s knowledge.

This section has dealt with the following parts of a measurement program: (1) evolution of tests; (2) test construction; and (3) uses of tests. When the measurement has been as accurate and fair as possible, evaluation should be the next step. A study of the different evaluative processes is presented next.

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Evaluation of Industrial Arts

Evaluation is an essential aspect of any instructional program. It includes testing, discussed in the previous section, as well as other examination techniques. Evaluation is designed to indicate whether the teacher has taught and whether the learner has learned. Evaluation answers the questions, has the educational program reached its goals, and is it changing student behavior?15

In an industrial arts evaluation program, it is felt that there are three main areas of evaluation: teacher evaluation of student achievement, student self-evaluation, and grading of students by the teacher. The first area of evaluation to be considered is teacher evaluation of student achievement.

Teacher evaluation of student achievement. The evaluation phase of industrial arts courses must be more than the development of a list of student grades.16 A good evaluation program evaluates all course skills, provides information regarding individual units and whole course effectiveness, and shows the strengths and weaknesses of the teacher. Evaluation should be continuous, and of value to students and teachers.

Evaluation procedures and techniques should help students develop a realistic appraisal of their abilities and limitations and teach them to use their strengths and abilities to overcome their shortcomings.

The greatest difficulty facing evaluation programs is the teacher's desire to spare student feelings and his own feeling that his teaching is

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15Roberts, op. cit., p. 231.
16Silvius, op. cit., p. 346.
perfect. 17

It is relatively easy to develop an evaluation program based on unit
tests (content), activities (skill and/or knowledge), and a final course
examination. Even if tests are adequately prepared and graded, the teacher
has only evaluated factual information and operational procedures. Factual
information often represents only one or two of the course objectives.
Other objectives such as leadership development, problem-solving ability,
and attitudes toward safety precautions, industry and society are not con-
sidered in this phase of evaluating and will be over-looked unless other
means are used along with unit tests, tests on skills and knowledge. 18

The importance of each objective is equal and all need to be evaluated.
The weight given student accomplishment of each objective is left up to the
individual teacher.

In their book Organizing Course Materials for Industrial Education,
Silvius and Bohn present a procedure in student evaluation. Their activity
grading sheet includes self-evaluation made by the student along with that
of the teacher. Evaluation of student accomplishment is made in comparison
to other students in class. 19

A written examination can be used to measure student knowledge in
understanding technical information and concepts. Other devices that could
be used to evaluate skill in use of tools would be comparing students'
projects with other projects that have been completed correctly.\textsuperscript{20}

Daily observation by the teacher of the students is at times considered one of the most valuable techniques of evaluation according to William A. Bakamis.\textsuperscript{21} On the other hand he also states that evaluation of students by teachers is not limited to observation alone.

Many skills in industrial arts lend themselves easily to objective evaluation, while others involve a subjective approach.

Laboratory activities are more difficult to evaluate than informational topics or safety precautions. Where the laboratory program provides opportunity for students to plan, design, and construct projects individually or in a group, evaluation is a challenge to the teacher. Course aims will usually dictate activities to be emphasized and hence the activities that require evaluation.\textsuperscript{22}

Evaluation by the teacher discussed above points out that evaluation should be made of course skills and help determine course effectiveness as well as strengths and weaknesses of the teacher. Evaluation should help students appraise their abilities and limitations. A discussion of student self-evaluation follows, showing the importance of student self-evaluation and its possible shortcomings.

\textbf{Student Self-evaluation.} In a program of student self-evaluation, enthusiastic student participation is one of the greatest motivating forces.


\textsuperscript{21}\textit{Ibid.}, p. 138.

\textsuperscript{22}\textit{Silvius, op. cit.}, p. 359.
Students evaluating their own work are made aware of and become concerned with doing a good job in the workshop. To have good student self-evaluation depends on good leadership from the instructor; it is not a time for teachers to relax.  

At an industrial arts meeting of the American Vocational Association in St. Louis, in 1956, student participation in evaluation was endorsed. This endorsement was made on the premise that students should (a) be aware of the objectives of an industrial arts course; (b) should evaluate their work in terms of skills, finished projects, information and attitudes.

Regarding student self-evaluation, Allen maintains that teachers' evaluation or judgment alone is not always a true measure of the student's progress in project construction. It is a known fact that teachers often have preconceived convictions as to a student's abilities. A student should be given a chance to evaluate his project to help him understand the evaluation of the teacher. By having a student evaluate his own project, he learns certain criteria considered important in project construction.

To date, student self-evaluation has chiefly been concerned with self-evaluation in regards to a project completed, but it could work into other phases of instruction such as attitude and safety. Good self-evaluation by students could contribute to efficient class operation by developing an understanding of the teacher's evaluation and helping the student look at

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24 Ibid., p. 23.

his own and others progress realistically.

Many check lists can be developed to help students in self-evaluation. A list proposed by Silvius and Bohn\textsuperscript{26} for student self-evaluation included checking accuracy in terms of dimensions on drawing, finish marks, amount of materials used, quality of finish, and the student's feeling towards the finished project, as shown below.

**Student Project Self-Evaluation Form**

Name ___________________________ Date ___________________________

Name of Project

Directions:

1. As you complete your project, check it against your drawing to see whether your measurements are:
   (a) _____ exactly correct to specifications.
   (b) _____ 1/32" above or below specifications.
   (c) _____ 1/16" above or below specifications.
   (d) _____ 1/8" or more above or below specifications.

2. Are the tool marks:
   (a) _____ entirely removed?
   (b) _____ slightly visible?
   (c) _____ plainly seen?

3. To complete your project, did you need:
   (a) _____ just one issue of materials?
   (b) _____ reissue of materials?

4. Did you finish your project?
   (a) _____ smoothly without laps and runs?
   (b) _____ with a few laps and runs?
   (c) _____ with several laps and runs?

5. Are you proud and happy with the final results? _____Yes _____No

\textsuperscript{26}Silvius and Bohn, \textit{op. cit.}, p. 350.
Evaluation by students has been criticized for the time consumed in relation to the value of such a procedure. Teachers using student self-evaluation must guard against these three points: (1) some students tend to rate themselves too low; (2) some students tend to rate themselves too high; (3) whenever the teacher feels self-evaluation by students a waste of time, the method should be dropped.

Student self-evaluation can play an important role in the over-all program of evaluation in industrial arts. Teachers should be sure the students know what is expected of them in self-evaluation and some type of form is vital to help the student accomplish the task of self-evaluation. The use of a student self-evaluation program discussed in the foregoing section brings to light some of the values and pitfalls of such a program. A good student self-evaluation program will help students become aware of the objectives of industrial arts and will help students evaluate their own work. The teacher using student self-evaluation should guard against student prejudices. The third step to be considered in evaluation is grading which is discussed in the next section.

Grading. There are many factors that need to be considered in a marking system. Probably the most perplexing problem in marking is determining what to evaluate. Some of the knowledge gained in industrial arts is fairly easy to test for, while the knowledge may be intangible presents quite a problem if a teacher is to be fair and just.27

Early industrial arts teachers placed the emphasis for marking on the project completed in the shop. In recent years with the objectives of industrial arts corresponding to the objectives of general education, emphasis on grading has shifted from the projects somewhat to the considerations of other areas of learning, such as quality of work performed, amount of work accomplished, knowledge acquired and applied, visualization and planning, effort put forth, and habits and attitudes.  

Quality of work, related information, cooperation with fellow workers, and time involved in completing a project are four of the factors in arriving at a mark for students as listed by Silvius and Curry.  

It is generally agreed by authorities in the field of industrial arts that each course should have a plan for arriving at fair and impartial grades for students. The method used to grade should be included in the course of study. Clear, concise plans should result in grades fair and impartial to all students. The system used to grade should be simple enough so students will be able to understand the procedure. 

The system should be objective; subjective, spur-of-the-moment grades are too easily influenced by mood and attitude of the teacher. 

An objective method of arriving at a grade based on points earned and course average was proposed by Silvius and Bohn. Their plan allows points for each activity, test and other class contributions. These points are kept cumulatively as units are finished and used as the base for periodic  

28 Ericson, op. cit., p. 219.  
29 See Appendix B.  
30 Silvius and Bohn, op. cit., pp. 372-373.
report card marking and the mark given at the end of the term. To deter-
mine course average each activity test and other class contribution is eval-
uated against a common base (highest achievement is 100 per cent) and given
a relative weight in relation to the other activities. The total is averaged
and the final grade based on either predetermined limits (90-100 or 94-100
equals A), statistical distribution, or rank order.

There are many factors that need to be considered in a marking system.
Quality of work, related information, cooperation with fellow workers, and
time involved in completing a project are four factors to consider in
arriving at a mark. A system of arriving at a mark should be included in
the course of study and the teacher will want to stick to his system in
order to avoid any unfair judgments he may make.

Summary

The foregoing chapter discusses the measurement and evaluation as-
pert of industrial arts. The first section deals with measurement and is
broken into three parts: (1) evaluation of tests; (2) test construction;
and (3) uses of tests. The section on evaluation is also broken down into
three sections dealing with teacher evaluation, student self-evaluation,
and finally grading.

Important points to consider in teacher evaluation include:
(1) teacher evaluation should be made of course skills; (2) it should help
determine course effectiveness; (3) as well as strengths and weaknesses of
the teacher; and (4) it should help students appraise their abilities and
limitations.
Student self-evaluation can also play an important part in an evaluation program. A good student self-evaluation program will help students become aware of the objectives of industrial arts and will help students evaluate their own work.

Grading, which perhaps is one of the final steps in evaluation, can be a perplexing problem. Factors that are considered in most marking systems are quality of work, related information, cooperation with fellow workers and time involved in completing a project. Each individual teacher also may set up other factors that he may consider when assigning a grade.

Methods of measurement and evaluation of student achievement in woodworking used by Montana industrial arts teachers will be discussed in the following chapter.
CHAPTER III

AREAS CONSIDERED AND METHODS OF MEASUREMENT AND EVALUATION OF STUDENT ACHIEVEMENT IN WOODWORKING USED BY MONTANA INDUSTRIAL ARTS TEACHERS

The purpose of this investigation was to determine the areas considered and methods of measurement and evaluation used by Montana industrial arts teachers in woodworking.

In order to determine areas considered and the methods of measurement and evaluation of student achievement in woodworking used by Montana industrial arts teachers, a questionnaire was developed and utilized. The questionnaire was designed to determine what and how Montana teachers measure and evaluate knowledge and skills of students in industrial arts. The questionnaire was divided into four parts for ease of checking. The four parts of the questionnaire were (1) area of instruction and method of measurement, (2) qualities considered in evaluation, (3) project evaluation and percentage of grade, and (4) general practices in regard to grading. To establish the validity of the questionnaire, it was administered to three industrial arts instructors for criticism and some changes were made for clarification purposes.

The questionnaire and letter\(^1\) explaining the questionnaire were sent to 123 industrial arts teachers that were listed in the 1960-61 directory of industrial arts teachers in Montana, edited by the State Department of Public Instruction, Helena, Montana. Of the 123 questionnaires sent out, 71 were returned; of these 71, 67 were completed. The analysis of the 67

\(^1\)See Appendix D.
completed questionnaires, which follows, will be presented in four main parts of the questionnaire. The four main parts are (1) area of instruction and method of measurement, (2) qualities considered in evaluation, (3) project evaluation and percentage of grade involved, and (4) general practices in regard to grading. The results will also be shown through the use of tables which follow each part of the questionnaire discussed.

Areas of Instruction and Method of Measurement

The subject matter for instruction and method of measurement as revealed by a study of literature in the field of industrial arts can be broken down into five main areas as follows: (1) knowledge and use of hand and power tools; (2) general safety; (3) use of hand tools effectively; (4) use of machines effectively; and (5) related information. The results in these areas according to how the teachers checked the questionnaire follow.

The indications on the 67 questionnaires in the area of knowledge of hand and power tools, as to being able to identify and knowing what they are used for, was 67 teachers considered this area of instruction for evaluation. Sixty-one measured student knowledge in this area by written tests and forty-four by observation. Other methods written in by teachers were student demonstrations, verbal tests, oral reports, and discussions.

In the area of general safety, of the 67 completed questionnaires 67 checked this area of instruction for measurement and evaluation. Fifty-six showed they assessed the students' knowledge by written tests, 55 by observation. Other methods teachers listed were students checking each other and class discussion.
Another area which 67 of the 67 teachers returning the questionnaire checked was the ability to use hand tools effectively. Thirty-three checked that written tests were used and sixty indicated they used observation. Other methods written in by teachers were as follows: (1) exercises; (2) practical application; (3) class given demonstrations by individual students; (4) manipulative test; (5) students pass on actual use test.

In the ability to use machines effectively area, 66 of the 67 teachers indicated they consider this area in evaluating students. Forty used the written test method of measurement, and 53 used the observation method. Other methods used were (1) student performance, (2) through use, (3) students demonstrate as an individual, (4) manipulative test, and (5) manual ability-project.

The area concerned with related information, other than ordinary shop work was checked by 55 teachers of the 67. Forty-nine used a written test and 16 used observation as a means of measurement. Other methods used by teachers were (1) accumulation of printed materials and samples, (2) written and oral reports, and (3) field trips.

A table showing the distribution of responses in regard to the areas of instruction considered in evaluation and methods of measurement used follows. Part two of the questionnaire, which concerned qualities considered in evaluation will be discussed following Table 1.
<table>
<thead>
<tr>
<th>Area</th>
<th>Number of teachers checking area</th>
<th>Methods used and number of teachers using these methods of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge of hand and power tools, as to being able to identify and know what they are used for.</td>
<td>65</td>
<td>61 44</td>
</tr>
<tr>
<td>2. General safety, knowledge of.</td>
<td>67</td>
<td>56 55</td>
</tr>
<tr>
<td>3. Use of hand tools, ability to use effectively.</td>
<td>65</td>
<td>33 60</td>
</tr>
<tr>
<td>4. Use of machines, ability to use effectively.</td>
<td>66</td>
<td>40 53</td>
</tr>
<tr>
<td>5. Related information, other than ordinary shop work.</td>
<td>55</td>
<td>49 16</td>
</tr>
</tbody>
</table>
Qualities Considered in Evaluation of Students

The second part of the questionnaire dealt with the qualities considered in the evaluation of a student. The teachers of industrial arts woodworking were asked to check their practice in considering these qualities. A yes, no, and sometimes blank was to be checked if they considered the quality part of their evaluation. The responses were analyzed by means of the Chi Square technique, to determine the extent of agreement among the respondents considering the qualities in evaluation of students.

The teachers polled were agreed that the qualities of recitation, promptness, effort, self-reliance, cooperation, attitude, conduct, abuse of tools, practice of safety, dependability and courtesy were important in evaluation of students at .1% level of significance. They were not agreed as to the importance of student self-evaluation and spelling.

2 Steps in the computation and use of Chi (Χ²) test for k independent samples

1. Cast the observed frequencies in a k x r contingency table, using the k columns for the groups and the r rows for the conditions.

2. Determine the expected frequency for each cell by finding the product of the marginal totals common to it and dividing this product by N. (N is the sum of each group of marginal totals.) It represents the total number of independent observations. Inflated N's invalidate the test.

3. Compute Χ² by using the formula Χ² = \[(O - E)^2 \div E\] where O represents the observed frequency and E represents the expected frequency of each cell

4. Determine the degrees of freedom, df. df = (k - 1) (r - 1)

5. Determine the significance of the observed value of Χ² by reference to the proper tables. For a one-tailed test, halve the significance level shown. If the probability given for the observed value of Χ² for the observed value of df is equal to or smaller than the desired significance level, reject Η₀ in favor of Η₁. (Transparency made by Dr. John Picton, Montana State College.) Dowius, H. M., and Heath, R. W., Basic Statistical Methods, Harper and Row, New York, 1959, p. 266 with table.
Table 2 shows the distributions of responses made by the teachers of qualities considered in evaluating a student.

**TABLE 2. QUALITIES TAKEN INTO CONSIDERATION WHEN EVALUATING A STUDENT.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of teachers that consider item</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>1. Recitation</td>
<td>62</td>
<td>31</td>
</tr>
<tr>
<td>2. Promptness</td>
<td>66</td>
<td>56</td>
</tr>
<tr>
<td>3. Effort</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>4. Self-reliance</td>
<td>64</td>
<td>50</td>
</tr>
<tr>
<td>5. Co-operation</td>
<td>63</td>
<td>56</td>
</tr>
<tr>
<td>6. Attitude</td>
<td>67</td>
<td>60</td>
</tr>
<tr>
<td>7. Conduct</td>
<td>66</td>
<td>59</td>
</tr>
<tr>
<td>8. Abuse of tools</td>
<td>66</td>
<td>54</td>
</tr>
<tr>
<td>9. Practice of safety</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>10. Student's own evaluation</td>
<td>62</td>
<td>16</td>
</tr>
<tr>
<td>11. Dependability</td>
<td>65</td>
<td>57</td>
</tr>
<tr>
<td>12. Courtesy</td>
<td>67</td>
<td>46</td>
</tr>
<tr>
<td>13. Spelling</td>
<td>59</td>
<td>24</td>
</tr>
</tbody>
</table>

Qualities not listed on the questionnaire and added by teachers were as follows: (1) willingness to help others and show others; (2) ability to follow instructions; (3) attendance; (4) physical handicaps; (5) background preparation; (6) mechanical aptitude test; (7) creative efforts; (8) shop responsibility; (9) originality; (10) all over improvement; (11) making
arrangements and securing supplies; (12) clean up; (13) plan of procedure; (14) appearance; (15) types of projects chosen; (16) capabilities; (17) honesty; (18) leadership; (19) interest in class; (20) initiative; (21) industry; (22) neatness; (23) ability to work and plan.

The third part of the questionnaire dealt with project evaluation and percentage of grade.

**Project Evaluation**

If the student's project was evaluated, the teachers were asked to check a list of ten items that could be considered. The responses to the questions as to items considered when grading projects and the number of teachers checking the items is given in Table 3.

**TABLE 3. ITEMS CONSIDERED IN PROJECT EVALUATION.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of teachers checking the item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preplanning</td>
<td>46</td>
</tr>
<tr>
<td>2. Design</td>
<td>39</td>
</tr>
<tr>
<td>3. Joints</td>
<td>43</td>
</tr>
<tr>
<td>4. Gluing</td>
<td>37</td>
</tr>
<tr>
<td>5. Assembly</td>
<td>44</td>
</tr>
<tr>
<td>6. Finish</td>
<td>40</td>
</tr>
<tr>
<td>7. General appearance</td>
<td>52</td>
</tr>
<tr>
<td>8. Accuracy</td>
<td>49</td>
</tr>
<tr>
<td>9. Wasted material</td>
<td>27</td>
</tr>
<tr>
<td>10. Time to complete</td>
<td>38</td>
</tr>
<tr>
<td>11. Report on project</td>
<td>6</td>
</tr>
</tbody>
</table>
Of the items considered in project evaluation general appearance and accuracy were considered the most important. Preplanning, design, joints, gluing, assembly, finish and time to complete were considered important by more than half of the teachers returning the questionnaire. The least considered items were wasted material and report on project. Of all the items considered in project evaluation the project report was considered least with less than 10% of the teachers reporting considering it.

The fourth part of the questionnaire was concerned with the general practices in regard to project grading, mastery of skills and manipulations in grading students and the percentage of the total grade that the project counts.

General Practices in Regard to Grading

This section of the questionnaire was divided into several parts and the teachers were requested to check yes and no answers and to give percentages. The following is a breakdown of this section, listing additional comments made by teachers.

The number of teachers who indicated that they did grade the project while it was being constructed was 43; fifteen indicated they did not grade the project while it was being constructed.

The next question asked in the section was Do you grade the project only upon completion? Thirty-five teachers indicated they did. Several of the teachers marked both questions which were, Do you grade the project while it is being constructed? and Do you grade the project only upon completion?, thus creating what appears to be a discrepancy in tabulation of the responses to the two questions above.
Mastery of skills and manipulation as a factor in project evaluation was considered by 55 teachers. Two indicated they did not consider mastery of skills and manipulations.

In regard to what percent the project counted in the final grade, the teachers listed percentages from 10% to 90%. There were 18 teachers that indicated that they counted the project grade as 50% of the final grade.

Additional interesting comments made by the teachers follow:

1. The student must pass his written exams with a 70% average before any projects or exercises are counted toward his grade. If he fails the written exams, he fails the course.

2. I use a slightly different method in arriving at the grade. I deduct for the things that are not right and grade accordingly. I also grade on use of tools, etc., each day.

3. The completed projects constitute their year's work and grade.

4. I don't, as a rule, use a certain percent. I feel that it varies with each project.

5. I am a firm believer in good conduct on the part of the pupils. I tell the pupils their grades are based on: 1. general conduct, 2. quality of work, 3. test grades, 4. amount of work done.

6. Blessed be he who can give an accurate evaluation of any student. You will note that the project carries the most weight in the final grade. As a general rule, any student who does a good job on his project has been very cooperative, orderly, self-reliant, used his tools skillfully, conscientious, and applied wholesome effort to his work.

Summary

The purpose of this investigation was to determine areas considered and methods of measurement and evaluation used by Montana industrial arts teachers. In order to determine this a questionnaire was utilized.
Teachers of industrial arts woodworking who completed the questionnaire gave the author the impression that there was interest in the problems of measurement and evaluation. Fifty-four and four-tenths percent of the questionnaires were returned in a usable condition with many respondents making additional comments.

A significant proportion (94% in the area of knowledge of hand and power tools, 100% in the area of general safety, 94% in the area of the ability to use hand tools effectively, 96% in the area of the ability to use machines effectively, and 82% in the area of related information), of the returned questionnaire felt that the five areas of instruction listed on the first part of the questionnaire were part of the measurement and evaluation program. Methods used by the teachers often combined written tests as well as observation. In the areas of knowledge of hand and power tools and of related information, written tests outnumbered observation and other methods. In the areas of general safety and ability to use machines effectively, observation outnumbered the written test and other methods used. In the area of general safety, the difference was one between written tests and observation with 56 using written tests and 55 using observation, while four used other methods.

The thirteen qualities considered in evaluation of students listed on the questionnaire were considered by most of the teachers. The number of teachers checking these qualities ranged from 67 to 24. There were only three qualities which not more than 60 teachers checked; they were dependability 57, courtesy 46, and spelling 24. The application of the $X^2$ Chi formula to the responses to the qualities of students' own evaluation and spelling indicated that there was no great concern by the teachers one way
or another.

There were eleven items (preplanning, design, joints, gluing, assembly, finish, general appearance, accuracy, wasted material, time to complete, and report on project) listed on the questionnaire to be considered in project evaluation. The range as to the number of teachers considering these items in project evaluation was from 52 who considered the general appearance of a project to 6 who considered a report on the project.

The questions on general practices in regard to grading projects were included in the questionnaire to determine if there was a general practice which was used by a number of teachers. Forty-three teachers indicated that they graded the project while it was being constructed, but fifteen indicated they did not. Thirty-five teachers indicated they graded the project only upon completion. Fifty-five teachers indicated they did consider the mastery of skills and manipulations in project grading and two did not. Eighteen teachers indicated that the project grade counted as 50% of the total grade.

Perhaps the most significant fact brought out by the questionnaire is that there is in some instances where teachers seem to agree on what and how to measure and evaluate, but also in some practices there is a wide range of opinions in regard to the importance of the project in a final grade for the student. The project's importance as to the final grade ranged from 10 to 90 percent.

A summary of the purpose of this investigation with the writer's conclusions and recommendations are presented next.
CHAPTER IV
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this investigation was to determine the methods used by Montana industrial arts teachers to measure and evaluate skills and related information in woodworking.

The review of literature indicated that in order to measure and evaluate students' skills, one must first have in mind the objectives of industrial arts. A program of measurement and evaluation, to be effective and of value, should be built around the objectives. The review of literature brought out the importance of tests in industrial arts, plus their construction and uses in student evaluation. Evaluation, an essential part of an instructional program, was broken down into three main areas: teacher evaluation of student achievement, student self-evaluation, and grading of students by the teacher.

A questionnaire was developed and sent to 123 industrial arts teachers in Montana. Sixty-seven or 54.4% of the questionnaires were returned by the teachers. The teachers returning the questionnaire were in agreement as to areas which should be considered in an industrial arts program of measurement and evaluation and the methods used. They also were in agreement in regard to qualities to be considered in evaluating a student. Although there was a wide range as far as the importance of the project in the total grade given students, most of the teachers considered the project grade as part of the total grade.
Conclusions

Conclusions drawn from a review of literature are as follows:

1. It was generally agreed upon by authorities in the field of industrial arts education that the objectives of an industrial arts program should be the basis for a program of measurement and evaluation.

2. Measurement and evaluation should take all learning experiences into consideration.

3. Several methods of evaluation should be used, such as written tests, observation by the teacher and student self-evaluation, and students should be compared with one another.

4. Many factors should be considered in a marking system. Methods used to grade should be included in the course of study. The system of grading should be objective and not influenced by mood or attitude of teacher.

The results of the survey of industrial arts teachers led to these conclusions:

1. The teachers as a whole are in agreement as to the importance of these areas of instruction, knowledge of hand and power tools, general safety, use of hand tools, use of machines, and related information.

2. There is wide agreement as far as qualities considered in evaluation of students.

3. There is a wide range of differences of opinion as to what part each item in project evaluation should be considered.

4. There is general agreement by industrial arts teachers that the project should be considered part of the final grade.
5. There is further disagreement as to systems used in arriving at a final grade for a student.

Recommendations

The findings of the review of literature and the survey of the industrial arts teachers indicate several practices that were in agreement as well as those where they were not in agreement.

It is recommended that the industrial arts teacher keep in mind the objectives of their course in a measurement and evaluation program.

It is further recommended that industrial arts teachers set up factors in student achievement that they consider important in an evaluation program, since there were some 23 different qualities considered by one or more teachers.

It is finally recommended that the teachers arrive at some agreement as to the degree of importance of a project in a final grade and that weight each part of project construction should be given in grading the project. If there were some general agreement as to the importance of the project in the final grade, it is the writer's belief that this could bring about more uniformity in the teaching of industrial arts woodworking, since the project seems to be the vehicle through instruction in woodworking is given.
BIBLIOGRAPHY


APPENDIX
### APPENDIX A

**ACTIVITY GRADING SHEET**

<table>
<thead>
<tr>
<th>Student’s Name</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Unit</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Directions:** This sheet may be used by students or the teacher. The bottom section permits the comparing of self-evaluation made by the student along with that of the teacher. Rate each of the items on the five point scale by circling a number on the scale.

<table>
<thead>
<tr>
<th>Item</th>
<th>Best-in Class</th>
<th>Better Than Av</th>
<th>Class</th>
<th>Just Aver.</th>
<th>Below factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

**Student and Teacher Evaluation:** List the number circled above in each of the appropriate spaces. The total number of points will be used in determining final grade for the activity.
<table>
<thead>
<tr>
<th>Pre-planning</th>
<th>Design</th>
<th>Accuracy</th>
<th>Finish</th>
<th>Safety</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Teacher</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
1. The quality of work which a student produces is a markable factor. To make it as objective as possible, a marking scale to assist the teacher and the student may be useful. This scale may consist of several finished projects showing degrees of quality from excellent to poor. This scale could also be in the form of a check sheet with items that describe constructive criticism.

2. The student's knowledge of related information, essential for content enrichment, is a markable factor. This can be measured by oral questioning or by giving a short objective test at the conclusion of the instruction for a project.

3. It is often stated by leaders in industry and business that men lose their jobs not because of their inability to do the job, but because they are unable to get along with their fellow workers. Industrial education subjects provide opportunity for students to work with each other, use common tools and equipment, share in the maintenance of the laboratory, and work cooperatively with the other students and officers; each student's success in these endeavors should be evaluated. Harry Paine, while a professor at the University of Cincinnati, suggested that there were twelve factors that could be considered: "...the instructor should call the student's attention to the following important elements of shop morale and attitudes and attempt to improve them... (1) promptness and punctuality; (2) cooperation; (3) effort and perseverance; (4) appearance and fit dress; (5) social attitudes; (6) apparent interest; (7) reliability; (8) initiative; (9) leadership; (10) honesty; (11) loyalty; (12) neatness and orderliness." A grade on citizenship is subjective since it is based on judgment. The reliability of a citizenship mark may not be too high with beginning teachers; however, with experience, it should improve. The importance of evaluating is exemplified in this statement: "It is not so much what the student learns, but how he uses it. There are many intelligent men in our prisons today."

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4. The time necessary to do the project is an important factor. Some jobs may be completed in one class period, while others may take several periods. Certainly a student should not receive as much credit for a short job as he does for a long one.

"Since all jobs vary in the amount of time required for their completion, provisions should be made to compensate for these differences. An adequate arrangement is to assign a standard time (or average time) in terms of the number of class periods necessary for the usual student to do the job plus the time required for the teacher to present the instruction . . .3

The standard time for a project may or may not be the same from one class to another. For example, one class may include many students whose average intelligence is high, and another may be mostly slow learners. The slow learners probably will take longer to complete the manipulative work as well as to cover the teacher's instruction. For progressive industrial education teachers base their marks on the normal curve; comparisons are usually made within the student's group. A standard or average time for a project in each class, based on the ability of the students within the group as well as their progress, provides for healthy competitive evaluation.

APPENDIX C

AN OBJECTIVE METHOD OF ARRIVING AT A GRADE AS PROPOSED BY SILEVUS AND DOHN.

1. Points earned. Each activity, test, and other class contribution is awarded a number of points determined by quality and standard time. These points are kept cumulatively as units are finished and used as the basis for periodic report card marking and the mark given at the end of the term.

(a) Certain point ranges are established for the goal-- for example, all point totals for 200 receive an "A".

(b) Statistical distribution or rank order of points earned-- for example, the three students with the highest number of points receive "A", the next eight "B", etc.

2. Course average. Each activity, test, and other class contribution is evaluated against a common base (highest achievement is 100 per cent) and given a relative weight in relation to the other activities. The total is averaged and the final grade based on either predetermined limits (70-100 or 24-100 equals A), statistical distribution or rank order. For example, in a beginning woodworking course the following grades are received (equated on the basis of 100 being the highest possible score). In this example the major examinations considered twice as important as any of the unit tests are therefore given twice their relative weight.

| Unit Test I | 30 |
| Unit Test II | 65 |
| Unit Test III | 75 |
| Mid-Semester | 70 |
| (Double Value) | 70 |
| Course Examination | 90 |
| (Double Value) | 90 |
| Project #1 | 60 |
| Project #2 | 70 |
| Project #3 | 80 |

\[ 700 \div 10 = 73 \text{ per cent average grade} \]
APPENDIX D

LETTER AND QUESTIONNAIRE SENT TO MONTANA INDUSTRIAL ARTS TEACHERS

Dear Mr.,

It is my belief and that of other industrial arts teachers that I have talked to, that there are many different methods of measurement and evaluation in woodworking used by Montana industrial arts teachers. This assumption lead me to making a study of the various methods of measurement and evaluation used by Montana industrial arts teachers.

It is my intention to question all Montana industrial arts teachers teaching woodworking to determine their methods of measurement and evaluation. Your assistance will be valuable in making this study accurate. All replies will be considered and will be needed in compiling the information to determine the most common method or methods used.

Therefore, I am respectfully submitting the enclosed questionnaire, hoping it will be possible for you to find time in your busy schedule to complete and return it promptly for consolidation with others as a special graduate report in education.

All questionnaires remain confidential, no school or specific teacher's name will be used, and all materials will be destroyed upon completion of the final report. You will be furnished a copy of the final tabulation of responses.

Thank you for your part in helping me complete this survey.

Sincerely yours,

Henry Badt
Graduate Student

Enclosure
A QUESTIONNAIRE TO DETERMINE METHODS OF MEASUREMENT AND EVALUATION USED IN WOODWORKING BY MONTANA INDUSTRIAL ARTS TEACHERS

Directions: This questionnaire is designed to determine what and how you as an industrial arts teacher measure the knowledge and skills of your students in woodworking. Some of the questions may not pertain to your methods of measurement or to what you measure. If so, ignore the particular questions. On the other hand, if there is some phase of woodworking which you measure and it is not included, please use the space provided at the end of the questionnaire to give a brief description of your particular phase of evaluation and the method.

The questions will list a specific area with methods of measurement. If the area is used in your measurement and evaluation of a student, please check it. Then check the method or methods used to measure it.

<table>
<thead>
<tr>
<th>AREA</th>
<th>METHOD OF EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge of hand and power tools, as to being able to identify and know what they are used for.</td>
<td>written test, observation, other</td>
</tr>
<tr>
<td>2. General safety, knowledge of.</td>
<td>written test, observation, other</td>
</tr>
<tr>
<td>3. Use of hand tools, ability to use effectively.</td>
<td>written test, observation, other</td>
</tr>
<tr>
<td>4. Use of machines, ability to use effectively.</td>
<td>written test, observation, other</td>
</tr>
</tbody>
</table>
Do you take into consideration the following when evaluating a student? Check the response showing your practice.

<p>| | | | | | | | | |</p>
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</thead>
<tbody>
<tr>
<td>1. Recitation</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
<td></td>
<td></td>
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<td></td>
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<td>2. Promptness</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>3. Effort</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>4. Self-reliance</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>5. Co-operation</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>6. Attitude</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>7. Conduct</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>8. Abuse of tools</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>9. Practice of safety</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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<td>10. Student's own evaluation</td>
<td>_yes</td>
<td>_no</td>
<td>_sometimes</td>
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</table>
Please circle the appropriate response:

Do you grade the project while it is being constructed? Yes  No

Do you grade the project only upon completion? Yes  No

Do you consider the degree of mastery of skills and manipulations in grading students? Yes  No

How much do you consider the project grade in the final grade (approximate per cent)

Please use this space for any additional comments you wish to make.
11. Dependability
   ____ yes
   ____ no
   ____ sometimes

12. Courtesy
   ____ yes
   ____ no
   ____ sometimes

13. Spelling
   ____ yes
   ____ no
   ____ sometimes

14. Others
    ____ yes
    ____ no
    ____ sometimes

15. Others
    ____ yes
    ____ no
    ____ sometimes

16. Others
    ____ yes
    ____ no
    ____ sometimes

If you grade students' projects, would you please check the
items in the following list that you consider part of the grade. If
you use certain weights such as fifty percent of the grade represents
the accuracy and fifty percent the finish, would you also enter this
in the blank following the item.

<table>
<thead>
<tr>
<th>Check if you consider the item.</th>
<th>Item</th>
<th>Percentage of total grade</th>
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<tbody>
<tr>
<td></td>
<td>Pre-planning</td>
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<td>Design</td>
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<td>Joints</td>
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<td>Gluing</td>
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<td>Assembly</td>
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