AN ABSTRACT OF THE THESIS OF

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Title THE DEVELOPMENT OF A BRITISH COLUMBIA ACHIEVEMENT TEST FOR EIGHTH GRADE INDUSTRIAL ARTS

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The purpose of this study was to develop an achievement test suitable for eighth grade industrial arts, in the Province of British Columbia. The test was designed to conform to the limitations established in the curriculum bulletin, Industrial Arts 8, authorized in 1962. Norms were to be developed from the data resulting from the administration of the test in final form. On the basis of the results the test was to be examined for reliability and validity of the questions.

The review of literature helped establish the need for such a test, and suggested the form of some of the test items. It was of little assistance in the actual construction of standardized tests in industrial arts. The test items were developed with consideration to aims, outcomes, course content, as defined in the curriculum bulletin. They were also developed with references considered suitable for this grade level. Questions were constructed in each of the four areas studied in eighth grade. These areas are woodwork,

metalwork, electricity, and drafting. The trial set of questions were then submitted to a jury, consisting of personnel engaged in teacher education, and supervision, teachers of industrial arts, and student teachers of industrial arts. On the basis of the criticism received the questions were revised.

A test, consisting of 240 questions, 60 in each area, woodwork, metalwork, electricity, and drafting was prepared. This test was administered to 96 grade eight students in June, 1963. These questions were revised using both subjective analysis as well as objective item analysis. The subjective analysis was undertaken by a graduate class of experienced industrial arts teachers during the summer of 1963. The revised test contains 50 questions in each section. The ten poorest questions in each section were eliminated, and the remaining questions improved wherever possible. The test in final form was completed by 684 eighth grade students in 12 British Columbia schools in June, 1964.

The mean for the test in final form was found to be 84.71. The means for the individual sections of the test were as follows: woodwork 26.06, metalwork 24.87, electricity 22.64, drafting 12.97. The standard deviation is 19.73. 71.48% of all scores lie between plus one standard deviation, and minus one standard deviation. The reliability coefficient, calculated using the analysis of variance technique, is .89. An item analysis of all questions has been made and is discussed and full information presented.

THE DEVELOPMENT OF A BRITISH COLUMBIA ACHIEVEMENT TEST FOR EIGHTH GRADE INDUSTRIAL ARTS

by

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CHAPTER I

INTRODUCTION

One might claim that our modern industrial state depends upon, among other things, accurate measuring instruments. It can hardly be denied that the banker without his balance sheet, the doctor without his stethoscope, or the merchant without his scales, would be as lost as the mariner in mid-Pacific without his navigating instruments. The teacher is in much the same position as the mariner, for it is possible to navigate using past experience, and the north star, just the same as it is possible to use experience and teacher made tests for evaluating the teaching and learning situation. There is room to believe, however, that the development of more accurate measuring instruments should assist the teacher to be more effective. This is particularly true in the field of Industrial Arts--a field in which subjective judgment is sometimes the sole method of evaluation. It is possible also, that the use of testing devices that are familiar to academic administrators would assist them to better appreciate the vision of what could be the full potential of Industrial Arts.

I. THE PROBLEM

Statement of the problem. The purpose of this study was to develop an achievement test, suitable for evaluating eighth grade industrial arts in the Province of British Columbia. The questions were developed in the four areas, woodwork, metalwork, electricity, and drafting, which are outlined in the provincial curriculum bulletin. A further part of the problem consisted of preparing norms for the test, following its use in the field. The third part of the problem required that the test as developed, and the individual items of the test, be compared against recognized criteria for reliability, and validity, respectively.

Importance of the study. It was felt that the development of an achievement test would serve a number of purposes.

(1) It would assist the teacher to evaluate the students progress in a more objective manner.

(2) It would assist the teacher to evaluate his own work, and to some extent, by use of the norms, his weak areas.

(3) It would provide the student with additional guidance in determining his strong and weak areas. At the grade 9 and 10 levels the student may choose between courses in woodwork, metalwork, electricity, power mechanics and graphic arts, depending upon

the courses offered in the particular school. Two courses must be completed to qualify for the senior high school shop courses in grades 11 and 12. It is suggested that the result of an objective test score, when considered with other items such as completion of required work, in the form of projects, reading assignments and quizzes as the course progresses, would be of considerable assistance in planning his future program.

(4) No such test exists at the present time.

(5) It would supplement teacher made tests, and by virtue of having norms would have this extra value.

(6) It would provide an easy to administer, easy to mark, year end testing device.

(7) The test could be marked by individuals other than the teacher.

Limitations of the study. The limitations within which the test was developed are defined in the current bulletin INDUSTRIAL ARTS, 1962, INDUSTRIAL ARTS 8, SUPPLEMENT, Department of Education, Province of British Columbia. This course of study was first authorized for use in 1962, and it lists the aims and expected outcomes, as well as outlining subject topics and operations for the course.

The study was limited to students enrolled during the school year 1963-64, in the Province of British Columbia.

The norms were developed using a selective population consisting

of students enrolled in various British Columbia schools.

II. DEFINITIONS OF THE TERMS USED

Norm; The standard or criterion for judgment (22, p. 376).

Norm, grade; The mean or median achievement of pupils in a given school grade in a given standardized test (22, p. 376).

Sample; A finite number of observations, individuals or units selected from those which comprise a particular universe for the purpose of making an inference about the universe (22, p. 475).

Test; An examination or quiz; any kind of device or procedure for measuring ability, achievement, interest, etc. (22, p. 556).

Test, achievement; A test designed to measure a person's knowledge, skills, understandings, etc., in a given field taught in school, for example, a Mathematics test or an English test (22, p. 556).

Test, group; A test so constructed that it can be administered to a number of individuals at the same time (22, p. 560).

Test, multiple-choice; a recognition type of test in which the subject is asked to choose for each item the one correct or best answer for each item, the one correct or best answer from several suggested answers (22, p. 561).

Test, matching; A recognition form of objective test to which the pupil responds by attempting to match or pair the related items in two or more columns of related material (22, p. 561).

Test, objective; A test so constructed that different scorers working independently will arrive at the same or essentially the same score for a given performance; usually based on alternate response, multiple-choice, matching, or completion type questions; scored by means of a key of correct answers, any answer disagreeing with the key being regarded as wrong (22, p. 562).

Test, standardized; A test for which content has been selected and checked emperically, for which norms have been established, for which uniform methods of administering and scoring have been developed, and which may be scored with a relatively high degree of objectivity (22, p. 565).

CHAPTER II

REVIEW OF THE LITERATURE

The following paragraphs contain a review of the literature on the subject of achievement test for industrial arts, with particular reference to test standardization. The material considered first has to do with evaluation in general. There follows a review of material on test construction by men in the field, and finally some reference is made to tests of this type which have been developed in the past.

I. LITERATURE ON EVALUATION OF INDUSTRIAL ARTS

The idea has been expressed quite recently by Feirer that what Industrial Arts needs is a national curriculum (18, p. 15). Adoption of a national curriculum, he argues, could result in a way of effectively evaluating our program. It could lead to development of standardized tests, which are, for practical purposes, nonexistent now, and the use of such tests would confer distinct advantages.

Concern that Industrial Art was not well supplied with standardized tests was shown by Evans in an article on the construction of practical objective tests (15, p. 29). In addition he commented that what tests there were had been largely confined to the drafting area. The usual comment levelled at a test which examines content he

disposes of by remarking that if a course has content, then that content should be tested to see if it has been learned. He expresses the idea that as content becomes more technical that pencil and paper tests will become more important.

In a comprehensive report on evaluation in the industrial arts, Hutchcroft states that the two most common practices are the use of pencil and paper tests, and teacher judgment of the completed work (25, p. 693). He indicates that most of the tests measure achievement with respect to two objectives, knowledge and skill. He goes on to say that these two forms fail to measure all the objectives claimed for industrial arts. Conspicuous by its absence is any mention of standardized testing in the field.

The impression is sometimes left, that because pencil and paper tests do not measure the entire range of industrial art experience, that they are not too valuable. This idea comes under fire in the 4th Yearbook of the American Council on Industrial Arts Teacher Education (1, p. 148). The feeling is expressed that we should secure the evidence that we can secure in the two or three areas that we can measure. It is perhaps significant that in reporting on the survey made of teacher training institutions that a nil report was made to the question referring to the use made of standardized tests to determine various levels of student achievement (1, p. 155).

Many years ago, Metz, commented that it was unfortunate that

many in the field of industrial arts, who were doing outstanding work, did not realize the value of evaluation of their own and their students work. In that year, 1945, as if to emphasize the belief expressed in the editorial, the magazine, Industrial Arts and Vocational Education published a total of 27 articles on the subject of tests and testing (33, p. 51).

The effects of testing upon the students was discussed by Sellon, who, in the same article, noted the use of testing as a major method of ranking students (40, p. 63).

A correlation study by Novak and Scheuhing which attempted to predict success in industrial arts courses, infers the need to examine closely the system of grading used by the shop teachers. It is possible that this study could have used to advantage the results of more objective and precise grading methods (38, p. 393).

Finally the document, Evaluative Criteria, makes a number of recommendations. Three uses of evaluation in this field are suggested; (1) for student counselling, (2) to reveal strengths and weaknesses of pupils and teachers, and (3) for the purpose of identifying pupils of unusual promise in this field (11, p. 129).

II. LITERATURE ON INDUSTRIAL ARTS TEST CONSTRUCTION

Many articles have been written on the development and improvement of industrial arts testing.

Pendered has written that tests which contain questions requiring procedure re-arrangement are very close to the performance test (39, p. 4).

A test constructed by Erickson has 46 multiple choice items on shop safety. As safety is an important objective, it is apparent that in order to be safe the student must be deliberately instructed. In this area the accent must be on prevention, and such a test gives proof that the student knows how to act safely (14, p. 134).

Some other articles which have suggested either improved methods of writing objective tests, or which have offered actual examples of tests have been produced by Knoll (30, p. 293), Jarvis (26, p. 41), Lux (32, p. 20A), Minelli (35, p. 263), Jarvis and Lux (27, p. 34), and Jenson (28, p. 59).

In their textbook, Newkirk and Green, have reported on some standardized and unstandardized industrial arts tests which existed at the time of writing their book. They make a very interesting observation on the value of validation studies, as a strong influence in tending to define and set up standards of accomplishment in industrial arts (36, p. 64).

Micheels and Karnes have discussed very fully most aspects of testing in the industrial arts (34).

III. LITERATURE ON STANDARDIZED TESTS IN INDUSTRIAL ARTS

Buros has listed and reported on both available and out of print standardized tests in industrial arts (8, 9, 10). Tests are listed mainly in the drafting area, with some in auto mechanics, and some in woodwork. Two which might be considered for use in a general industrial arts program are the Every Pupil Scholarship Test (9, p. 575) and the Middleton Industrial Arts Test (8, p. 504) of 1951. Norms are given for the Every Pupil Scholarship Test but no data on reliability. A review by Dr. William Micheels is given for the Middleton Industrial Arts Test.

IV. CONCLUSION

The review of the literature was helpful in that it yielded confirmatory opinion on the importance of the study, and the use of a pencil and paper objective test as a suitable measuring instrument. Another source of help was found in the suggestions on test construction for this subject. Very little of value was found that had bearing on actual standardized tests in industrial arts. No trace of such a test was found for the Province of British Columbia and neither of the tests mentioned were considered of value for the purpose of this study. The review of literature indicated that a great deal more interest in testing, was shown during the decade of the 1940's than has been shown since.

CHAPTER III

FORMULATION AND TRIAL OF THE FIRST SET OF QUESTIONS

The first problem in this study was to develop a representative set of questions. These were then tried under actual classroom conditions. The resulting data is presented in table form, wherever possible.

I. CONSIDERATION OF TYPE OF TEST

Before any questions could be formulated it was first necessary to decide on the type and form of the test.

The reasons for choosing an objective pencil and paper type of test were as follows:

(1) Ease of administration.

(2) Greater survey of content in a short period of time.

(3) Statistical treatment is more easily applied.

(4) Differing shop facilities would have less effect on results, as compared with a performance test in each shop area.

(5) There is need to test for knowledge of the subject, which is necessary to perform satisfactorily in this field (15, p. 29). It is conceded that a student with poor reading ability will not necessarily perform as well on this type of test as he might in

a shop situation, providing that he was not expected to read and understand to perform the shop test.

(6) The objective pencil and paper test is a recognized method of of testing subject content and to a limited extent, skills.

(7) The pencil and paper form of test can be administered in any classroom making it possible to maintain controlled test conditions.

II. CONSIDERATION OF TYPE OF QUESTION

The final decision that remained concerned the choice of the best type of objective questions to use for a standardized test in industrial arts. Wood (44, p. 24-30) has discussed the advantages of the use of multiple choice questions and the variant matching questions in objective testing, as well as other types. On the basis of the argument presented, it was decided, for the purpose of this study, to rely largely on the multiple choice type of question and the matching type. Despite the difficulty of scoring rank-order questions, some were included, because of the fact that such questions are close to being a performance type of question. Completion questions were considered to be less objective and were not used (44, p. 29). True-false questions were considered, but not used because of the difficulty of building in a standard of truth or falsity by which the item could be judged by the student (44, p. 24).

III. CONSIDERATION OF LIMITING FACTORS

The next factor that was considered, was the limitations, within which the questions were developed. For this reason the questions were prepared from material contained in the provincial curriculum bulletin, which states the aims, outcomes, and actual operations and related information, to be taught (6, p. 7-10).

Aims of Industrial Arts. The aims, as presented in, Industrial Arts, 1962, Industrial Arts 8, Supplement; for the Province of British Columbia, are:

(1) To teach principles of technology and to apply these principles in practical situations.

(2) To explore and evaluate the interests and aptitudes in technological fields.

(3) To establish a broad base of technological skills which will provide a sound foundation for subsequent development of the individual.

(4) To develop habits of systematic planning and safe practices in the solution of technological problems.

Expected outcomes. Outcomes, relating directly to the junior secondary school, are listed as follows:

(1) A mastery to a greater or lesser degree of technological principles.

(2) A development of some measure of skill with basic tools.

(3) An acquiring of knowledge of the source, properties, and uses of more common industrial materials.

(4) A gaining of some measure of success in the solving of industrial problems of systematic planning.

(5) A development of some appreciation of sound construction and design.

(6) A development of some understanding and appreciation of possible vocational value of several areas of work undertaken in relation to the pupils own abilities and aptitudes.

(7) A recognition of the functional value of English, mathematics, and general science courses in relation to the industrial world.

(8) A learning of safe practices.

Uses of tests. The following uses of tests are cited (6, p. 7):

(1) To discover student capacities.

(2) To measure achievement.

(3) To stimulate learning.

(4) To reveal strengths and weakness of teaching.

The four areas covered in the curriculum bulletin, Industrial Arts, 1962, Industrial Arts 8, Supplement, for British Columbia, are: (1) woodwork, (2) metalwork, (3) electricity, and (4) drafting. The time allotment in an average school situation using a time-table having a seven day week, is four periods of about 60 minutes each.

The seven day school week refers to a school time-table of 35 periods, having five periods per school day, and requiring seven school days to complete one cycle.

IV. FRAMING THE TRIAL QUESTIONS

Limiting factors. Each of the four courses which make up eighth grade industrial arts was systematically broken down into units. Within each of these units questions were formed, dealing with the informational content, safety practices, calculations, principles and procedures.

As British Columbia does not have a prescribed textbook or textbooks for this course, it was necessary to formulate questions by taking the individual operation and checking to find what appeared to be the common treatment in textbooks suitable for this grade level. For this purpose four textbooks, listed in Bibliography, were considered to be suitable as basic references. These are numbers 7, 16, 17, 42. Fourteen other textbooks were used as supplementary references and are listed as numbers 2, 4, 12, 13, 20, 21, 23, 24, 29, 31, 37, 41, 43, 45 in the Bibliography.

Composition of trial questions. The first set of questions were prepared on the following areas:

(1) Woodwork-----79 multiple choice questions.

(2) Metalwork---- 50 multiple choice questions.

(3) Electricity----67 multiple choice questions.
20 matching questions.

(4) Drafting------60 matching questions.

V. CRITICAL EVALUATION OF THE QUESTIONS

Critical examination by jury. The questions were mimeographed and sent out with a covering letter to teachers of industrial arts, who were asked to serve as a jury (Appendix A). To facilitate return of their suggestions, a self-addressed, stamped, reply envelope was enclosed. The distribution and returns of this pilot 'questionnaire' is given in Table 1.

Table 1 indicates the composition of the jury members. Included are those engaged in teacher education, inspectors of classes of industrial education, teachers engaged in teaching industrial arts, and some college students preparing to be teachers of industrial arts. It will be noted that in some cases the number of participants exceeds the number of returns. In such cases one set of trial questions had been sent to the school. The questions were divided into the four subject areas, and each area was dealt with by the individual teacher, who taught that area, in that school.

The questions were then revised in line with the comments thus received. Deletions were made of questions that the jury considered to be of too difficult a level. Other questions that were considered doubtful in meaning, and where it appeared that doubt might remain

even after due consideration, were likewise deleted. As many of the suggestions, as possible, were adopted.

Table 1. Distribution and returns of the trial test questions.

Jury Members	Distribution	Returns	Actual Participants
Oregon State	1	1	1
Inspectors--I. Ed.	1	1	2
U. B. C. ----I. Ed.	1	1	3
Industrial Art teachers, (in field)	23	13	20
Southwest Missouri State (I. Ed. students)	1	1	5
Totals	27	17	31

Composition of test for pilot study. The final numbers of questions were then balanced to present 60 questions in each area, 240 in all. A set of directions for administration of the test, was prepared.

VI. SAMPLE USED IN PILOT STUDY

A total of 150 test booklets were prepared and distributed. The first sample was to have included 25 students from a rural school, 75 from a suburban school, and 50 from an urban area. Due to an unforeseen cancellation of classes the students from the urban area did not write the test. The actual sample included 80 students in a

suburban area and 16 students from a rural area. Two other papers were received from the rural school, but these were not used as they were incomplete.

VII. ANALYSIS OF THE PILOT STUDY

Results for the first test were as follows:

(1) Highest possible score----240.

(2) Highest actual score------179.

(3) Lowest score---------- 86.

(4) Range---------- 93.

(5) Mean---------- 135.18

(6) Median---------- 137.23

(7) Standard deviation--------- 22.05.

(8) Mode---------- 142.00

The complete test was composed of four sections, (1) woodwork, (2) metalwork, (3) electricity, and (4) drafting. Each of these parts is referred to as a sub test. These sub-tests were analyzed and the norms for each sub-test are presented in Table 2.

Table 2. Analysis of the subtests.

	Woodwork	Metalwork	Electricity	Drafting
Range	21-47 26	20-46 26	19-55 36	7-48 41
Mean	35.81	35.73	36.63	27.0
Median	35	36	36	26
Mode	35	35	36	27

Summary. In summary it might be suggested that the results of the pilot study were better than expected. It was noted that the drafting marks were low, and it was decided to check those questions very carefully for inclusion in the final form of the test. The next step that had to be considered was evaluation of the individual test questions in order to determine the composition of the final form of the test.

CHAPTER IV

DEVELOPMENT AND TRIAL OF TEST IN FINAL FORM

At this point there remained the problem of putting the test into its final form, and administering it to a representative sample of the population, after which the results could be examined critically.

I. FINAL SELECTION OF TEST QUESTIONS

The method used to determine which questions to include in the final form involved both subjective inspection and the use of item analysis involving limited statistical treatment.

Subjective examination by graduate class. The subjective inspection was carried out as an assignment by a graduate class in Tests and Measurements for Industrial Subjects, during the summer of 1963 at Oregon State University. Thirteen graduate students offered valuable and critical comment which was used in the revision and modification of questions. All members of this class were experienced Industrial Arts teachers.

Objective examination by item analysis. The item analysis was carried out as outlined by Micheels and Karnes (34, p. 477-481). The test items were divided into three groups: those which showed positive discrimination, those which showed positive discrimination, but

less than a ratio of two, and those showing negative discrimination. The ratio referred to is found by dividing the difference between the percentage figures for the top half of the students marking an item correctly, and the bottom half, by the standard error of the difference.

The questions which showed negative discrimination were discarded. The questions which contained decided positive discrimination were retained without change. The questions which fell in the mid group were revised. The subjective analysis afforded an impartial estimate which assisted in the reframing of individual questions. A total of fifty questions was retained in each area. These appear in Appendix B.

Directions for administration. Directions for administration were prepared. This was a revision of a set of directions prepared for the pilot study in 1963 (Appendix B).

The answer sheet. In the pilot study the student chose the number appearing before the best choice and placed it in the parenthesis found at the right of the question. It was found that marking was slow, and the physical number of pages (16) made it cumbersome when recording information. In the final form an answer sheet was used, a single sheet containing space for the 200 responses (Appendix B).

II. THE SAMPLE POPULATION

Following the preparation of the test proper, there remained the problem of selecting a sample population. The timing of the test proved to be awkward. It would have been more convenient for many men to have administered the test during the last week of June. As it was desirable to have the date earlier there was some reluctance in some areas to cooperate. In order to get a reasonably representative sample the investigator approached District Superintendents, school principals, and instructors either by letter or phone. A stamped card was included to facilitate the reply indicating the number of papers desired. Despite the timing, some men indicated that they would use the test as a year end examination and to accommodate them it was agreed that the raw scores would be forwarded to them prior to June 20th, 1964. This was done. Data on "norms," from this study, will be provided to all cooperating schools.

Consideration of the composition of the sample population. The sample population of B. C. industrial arts students appears to be reasonably representative. It is representative in the sense that it relates reasonably well to the centres of population of the Province. It does lack representation from the heavy mining centers and the fruit growing area of the interior. Most other occupational areas are represented In all cases, with the exception of Lake Cowichan, the

entire grade eight population in the school was tested. In one case (Maple Ridge) the entire school district grade eight population was included. This school district is located in the heavily populated Fraser Valley, on the outskirts of Metropolitan Vancouver. A rural community included was Vanderhoof which lies far up the Fraser River in thinly populated country. The David Thompson Junior-Senior Secondary School is situated in the city of Vancouver, the centre of population of the province. An attempt was made to assure that the sampling included students coming from families in various income groups, various ethnic groups, and various occupational groups.

Table 3 indicates the schools which administered the test in final form, and the community in which the school is located. Information is given indicating the number of test booklets sent to each school and the number of answer sheets returned by each participating school.

The papers were sent out during the third and fourth weeks of May. Stamped self addressed envelopes were enclosed for the return of the answer sheets.

Table 3. Distribution and returns of final test questions.

School	Area	No. of tests sent	No. of answer sheets returned
North Saanich	Sidney	50	43
Nechako Valley	Vanderhoof	40	31
George Bonner	Mill Bay	50	39
Ladysmith	Ladysmith	50	43
Mt. Prevost	Duncan	50	47
Quamichan	Duncan	90	75
Elizabeth Fisher	Victoria	80	78
David Thompson	Vancouver	200	173
Garibaldi	Maple Ridge (Haney)	90	76
Maple Ridge	Maple Ridge (Haney)	90	79
Pitt Meadows	Maple Ridge	70	57*
Lake Cowichan	Lake Cowichan	50	38*
	Totals	910	779

* Woodwork and metalwork sections, only, were completed.

III. TABULATION OF RESULTS

Upon receipt of the completed answer sheets, tabulation was commenced. In all cases this was completed and the raw scores forwarded to the schools involved. The marking was made as

automatic as possible by use of a key, which reduced marking to checking items which matched, and adding the scores.

From the data, norms were developed, a reliability coefficient, and an item analysis of the individual questions.

CHAPTER V

TEST RESULTS AND ANALYSIS

This section includes the results of an examination of the data collected from the answer sheets. The four types of information which have been considered are:

(1) The norms for the test and each individual subtest.

(2) The standard deviation, as an indication of spread.

(3) The reliability coefficient.

(4) The item analysis of the individual questions.

I. THE TEST NORMS

The summary of the test results is shown in Table 4. Results are included for each of the sub-tests as well as the test as a whole. The range, mean, median and mode are presented for both test and sub-tests.

The test results appear to be reasonably uniform, with the exception of drafting, which is very low. The drafting section produced the lowest score on the pilot study. The results appear to indicate that drafting standards as measured by this type of testing instrument, may not be as good as those in the other three areas.

Table 4. Summary of test results.

	Range		Mean	Median	Mode
Woodwork	10-41	31	26.06*	24	24
Metalwork	7-31	36	24.87*	24	24
Electricity	1-47	46	22.64**	22	22
Drafting	0-35	35	12.97**	12	12
Complete test	35-158	123	84.718**	84	72

* Includes Pitt Meadows and Lake Cowichan, 779 students.
** Calculated on the basis of 684 students.

II. THE STANDARD DEVIATION

The standard deviation for the test has been calculated to be 19.73, based on 784 cases. This information has been applied in Fig. 1 to both sides of the mean. It has been found that 71.84% of all scores lie between plus one standard deviation, and minus one standard deviation from the mean. Comparison of the figure, 71.48%, with the criteria of 68.28%, would indicate that a curve which is reasonably normal has been obtained. Further examination indicates that 94.73% of the scores lie between plus two standard deviations and minus two standard deviations from the mean. As the criteria for a normal curve is 95.44% of the frequencies, this would be further indication that a reasonably normal curve with a good spread has been obtained.

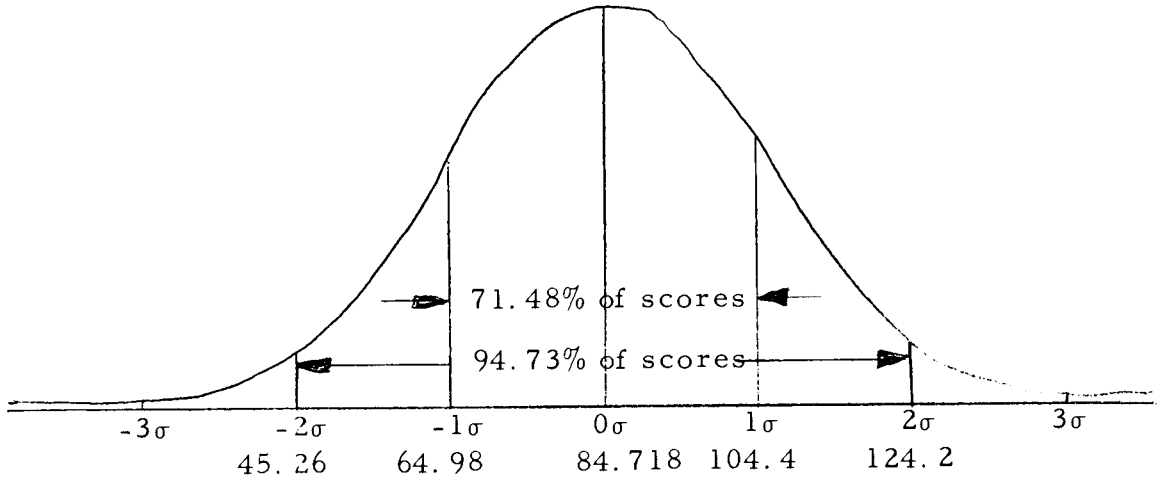

Fig. 1. Distribution of scores.

III. THE RELIABILITY COEFFICIENT

The reliability coefficient for the test has been calculated, using the procedure outlined by Micheels and Karnes (34, p. 472-477). This procedure is an analysis of variance technique. It has been used as an objective method of estimating test reliability. This estimate, the reliability coefficient, is .8979. The criteria as laid down for an achievement test by Micheels and Karnes for the reliability coefficient is .90 or above (34, p. 477). On the basis of this calculation the test does not appear to have quite reached a desirable level of reliability. However the validity of the individual items must be considered, and by elimination of the less valid items reliability should be improved.

IV. THE ITEM ANALYSIS

Consideration of terms used. The method of item analysis consists of finding the difference between the percentage figures for those in the top group marking an item correctly and those in the bottom group, marking the item correctly, and dividing by the standard error of the difference (34, p. 477-481). When the resultant ratio exceeds 2 the item is said to discriminate positively (34, p. 480).

N_1-----number in upper group marking item correctly.

P_1-----percentage of upper group marking item correctly.

N_2-----number in lower group marking item correctly.

P_2-----percentage of lower group marking item correctly.

Q_1-----percentage of upper group marking item incorrectly.

Q_2-----percentage of lower group marking item incorrectly.

X_1-----number in upper group.

X_2-----number in lower group.

The formula for the standard error of the difference is:

$$\text{S. Diff} = \sqrt{\frac{P_1Q_1}{X_1} + \frac{P_2Q_2}{X_2}}$$

Consideration of selected test items. With reference to the above explanation, three typical questions will be examined (Appendix C).

No. 15. To ensure safety a chisel is held (1) firmly, (2) lightly in both hands, (3) one hand firmly--other as a guide. (4) at a slight angle to the cut.

No. 67. Physical cleaning of a soldering copper involves the use of (1) solder, (2) sal ammoniac, (3) file, (4) tin.

No. 105. A negatively charged particle of electricity is called (1) electron, (2) proton, (3) neutron, (4) atom.

Table 5. Partial item analysis of selected questions.

No.	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{\text{S. Diff.}}$
15	165	48.24	183	53.50	-5.26	---	----
67	287	83.91	170	49.70	34.21	3.35	10.21
105	140	40.93	111	32.45	8.48	3.66	2.31

An examination of question 15 indicates a negative discrimination, as more of the lower group were able to respond correctly more times than were the students in the group which was considered to be higher. Such a question could be rejected or reworded after study to find why the best group of students had more difficulty than those in the lower group.

The second question to be considered, number 67, indicates a high degree of positive discrimination. It could be left in its

present form at this time.

The third item, question number 105, shows positive discrimination. Study of the responses to the various choices should reveal how effective the various choices are, and might suggest how to strengthen the weakest choices.

Consideration of validity of the test items. An inspection of the complete item analysis reveals, that the following questions fail to reach an acceptable level of validity in their present form.

Woodwork: 1, 6, 7, 10, 12, 15, 16, 20, 32, 37, 43, 44.

Metalwork: 53, 57, 62, 64, 65, 69.

Electricity: 109, 114, 120, 121, 188, 189, 190.

Drafting: 154, 155, 156, 171, 188, 189, 190.

It is suggested that the above questions either be eliminated or revised, should further use be made of the test.

Summary. In summary, the test might be said to have reached the point where it could be tried, after revision, on a larger population. This would assist in arriving at more accurate norms, and further refinement through item analysis should increase the validity of the individual items.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS FOR FURTHER CONSIDERATION

I. SUMMARY

The reason for this study was to construct a British Columbia achievement test for eighth grade industrial arts. This test was designed in conformity with the limits set by the course of study authorized in 1962. No previous study exists, as far as can be ascertained.

The items are objective, pencil and paper, multiple-choice type with some of the variant matching questions and a very few rank order questions. In order to ensure thorough coverage of course content, the questions were framed with reference to the course of study. Suitable tests were used as references.

The trial questions were submitted to men in the field, who acted as a jury, and reported their reactions to the individual questions. Their critical comments were incorporated into the questions. A total of 240 questions was prepared, consisting of 60 items in each area. These questions were used in a pilot study in June 1963.

On the basis of an item analysis, supplemented by a subjective study carried out by graduate students at Oregon State University, 40 of the poorest questions were eliminated. The least valid of those

remaining were reworded, adhering wherever possible to suggestions resulting from the subjective study. The resulting 200 questions were administered in 12 centers, in June 1964, to a minimum of 684 students.

The resulting data is presented as norms, an indication of reliability, and an item analysis of the individual questions which indicates a measure of validity for each of the questions.

II. RECOMMENDATIONS FOR FURTHER CONSIDERATION

(1) It would be possible to delete the poorest 10 questions in each section of the test, reconstruct those requiring improvement, and administer the new form to a larger population. Should this be done it is suggested that, at the time the test is prepared that it be set up preferably for machine marking, and at least on a basis making it possible to use a computer for sorting and calculating the information gathered.

(2) It is suggested that in the event that the test is further refined, that it would be possible to study the degree, if any, of correlation between scores on the individual tests and future success in unit shops. If correlation could be determined it might be possible to use the information in student course counseling.

(3) It is suggested that growing out of this pencil and paper test that some effort should be given to devising some standardized

performance tests to complement this test.

(4) One of the problems faced in constructing a test of this nature is the fact that there are many terms that are confusing. Standardization of terminology, even if only in the literature, would help not only in test construction, but also probably in bringing about greater uniformity in subject matter fields in the industrial arts.

(5) Revision of the test is recommended when a text is authorized for the course.

(6) Despite every effort toward accuracy in the original scoring of the answer sheets, because of illegible figures some items were marked incorrect. Further inspection during item analysis revealed this situation. Another source of error lay in the use of letters rather than numbers for items 176-180. It is suggested that an answer sheet requiring the student to fill in the appropriate square would probably improve the situation.

(7) There might be some merit in considering giving the test to the incoming grade eight class before any instruction is started. It is suggested that were such action taken that the students should be warned to answer only those questions they were familiar with, and further that the test was for teacher guidance only. The teacher might as a result of such a procedure be able to plan his work more effectively, and at the end of the year have a more complete evaluation of student growth during the year.

(8) It is recommended that should the test be standardized in the future that teachers be warned not to teach the test--for in so doing they would destroy its value.

(9) A suggestion for further study which could grow from the use of a sound standardized testing program would be the critical analysis of the course structure. The testing device, if sound, would permit the examination of whether or not course objectives were being reached--and would indicate some of the weak areas.

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APPENDICES

APPENDIX A

Copy of test desired ___Yes
___No

1091 - Laburnum Road,
Victoria, B. C.
April 4, 1963

Dear Sir:

I am working on a thesis entitled "The Development of a B. C. Achievement Test for Eighth Grade Industrial Arts". It was felt that the availability of such a test to Industrial Education teachers would be of considerable value. This work is being done under the supervision of Dr. C. B. Ainsworth, Head of Department of Industrial Arts, Oregon State University.

My reason for writing you is to request your assistance in reading critically this first draft of the questions. While questions on the four shop areas are included, you would perhaps prefer to check those in your interest areas. This will be a great help to me.

1. If you feel that a question is totally unsuitable, please draw a line through it.
2. If the body of the question is not clear, place a question mark over the area.
3. If the responses do not appear suitable, please place a question mark over them.
4. Any notes you care to make will be most appreciated.
5. As the final revision will likely be limited to 50 questions in each area, a "D" indicating deletion of questions of least importance, might be placed in the left margin.
6. If you would like a copy of the final test (probably ready in late summer of 1964), please indicate your wish at the top of this letter, and return it with the draft.

Please use the stamped, self-addressed envelope to return the papers to me. As it is hoped that a trial run of the test may be made this June, your asssitance in returning the test by April 17th would be extremely helpful.

It is the hope of the writer that the development of this test will be a forward step for our subject area--and it can only come about through the assistance of people such as yourself. Please accept my sincere thanks in advance for your help with this project.

Yours very truly,

Gregory C. Cook

Encls:

APPENDIX B

DIRECTIONS FOR ADMINISTRATION
Test in Industrial Education.
Grade VIII

1. The test may be given in one or two sittings. The latter is outlined below.
   Session 1. (a) Woodwork------20 minutes.
   (b) Metalwork------20 minutes.
   Session 2. (a) Electricity------20 minutes.
   (b) Drafting--------20 minutes.

2. In addition to having one copy of the test for each pupil, one is required for the teacher. Similarly answer sheets are required for each pupil and the teacher. At the end of the test all booklets are to be accounted for.

3. Each student will require two sharp pencils. There should be a reserve supply available.

4. A stop watch or watch with sweep second hand is required for the timing.

5. Arrange to have an uninterrupted period for administering the test; use of a 'Testing--Do Not Disturb' sign will help.

6. Careful study of the directions is essential if all students are to write the test under identical conditions. All students must have exactly the same time allowance, all must receive identical instructions.

7. The students should be seated as far apart as possible. A normal classroom atmosphere should be maintained.

8. Before the test begins write the following information on the blackboard; Date, the name of the school, and the city, town or village, as applicable.

FIRST SESSION

1. Say to the pupils--"This is a test to show how much you have learned this year. When you get your test booklet you may read the cover page, but do not write on it, or open the booklet." The test papers and the separate answer sheet are to be placed face side up on the desk of each student.
2. Say to the students--"Has everyone a sharp pencil ready?" When all are ready, proceed by saying, (Point out appropriate spots as outline proceeds), "The top line to the left of the answer sheet is for your name. Letter your last name, and then your given name or names, UNDERLINE the name you are usually called. On the

same line, to the right place todays date. On the second line fill in the name of the school, and the city. On the bottom line fill in your birth date, first the month, then the day of the month, and the year in which you were born. In the space following write the number of years you are old to-day." Point to the blackboard; "You may refer to the board for the date, and so on." "Are there any questions?"

3. Check to see that the students fill out the blanks as required.
4. When this has been completed, say to the children, "You may now read the instructions found on the cover. Note that all answers must be placed on the separate answer sheet, no marks are to be placed in the booklets."
5. As soon as the students have finished, say, "We are now ready to start. When I tell you to begin you are to open your booklet, read the directions at the top of the page, and then start the test. Ready? Begin." Note the time (hour, minute, second) that 'Begin' was said on the time record found at the end of the instructions. Calculate the finishing time by adding 20 minutes, and enter this time in the appropriate spot. Endeavour to give the students 20 minutes--exactly. It helps to watch the clock in the last five minutes.
6. At the end of 20 minutes say, "Stop, whether you are finished or not, turn now to the metalwork section. When I say 'begin' you are to read the instructions and start the test." If the test is taken in two sittings, say, "When you reach the end of this section you will find it marked 'stop'. You are not to proceed but may spend any time you have left working on the first section. Ready, begin."
7. As before jot down the time and calculate the finishing time.
8. At the end of 20 minutes say, "Stop, Close your booklets. Place the answer sheet just inside the cover." Have the last person in the row collect the booklets.

SECOND SESSION

9. Have monitors pass out the booklets.
10. Say to the pupils, "Has everyone received his own booklet, Turn to part three, it is the electrical section. When I say begin, you are to read the instructions, and then proceed to answer the questions in this section. Ready? Begin."
11. Record the time and calculate the finishing time for this section.
12. At the end of 20 minutes say, "Stop. Turn to the last section, which is marked 'Drafting', after reading the instructions, you may start. Ready? Begin."
13. Record the time and calculate finish time.
14. At the end of 20 minutes say, "Stop. Whether you are finished or not, close your booklets."
15. Bundle up test booklets and answer sheets separately. Return answer sheets for marking.

Industrial Education--GradeVIII--1964.

Time Record.

School Dist. _____ No. _____ School _____

Div. No. (s) _____ Test Administrator _____

Length of period _____ min. No. of periods per week (school week) _____

Number of days in school week _____ Are the four courses carried throughout the year. Yes ___ No ___ If 'no' please indicate if courses are arranged in quarters or if two courses are carried part year and the remaining two the rest of the year.

SESSION ONE

	Hour	Minute	Second
Time 'begin' was said for section 1. ___			
Add _____		20	
Time to say 'stop' _____			
Time 'begin' was said for section 2. ___			
Add _____		20	
Time to say 'stop' _____			

SESSION TWO

Time 'begin' was said for section 3. ___			
Add _____		20	
Time to say 'stop' _____			
Time 'begin' was said for section 4. ___			
Add _____		20	
Time to say 'stop' _____			

Any comment you have on the adequacy of the time allotment would be appreciated.

If you wish to have the raw scores for your students please fill out their names below. You should receive the scores around the 20th of June.

School. _____ Address to which scores are to be sent _____

_____

Student.	Score	Student	Score
1. _____	_____	13. _____	_____
2. _____	_____	14. _____	_____
3. _____	_____	15. _____	_____
4. _____	_____	16. _____	_____
5. _____	_____	17. _____	_____
6. _____	_____	18. _____	_____
7. _____	_____	19. _____	_____
8. _____	_____	20. _____	_____
9. _____	_____	21. _____	_____
10. _____	_____	22. _____	_____
11. _____	_____	23. _____	_____
12. _____	_____	24. _____	_____

INDUSTRIAL EDUCATION
GRADE VIII

General Directions:

This test consists of four parts; woodwork, metalwork, electricity and drafting. You will be given exactly 20 minutes to answer the questions in each section. When your teacher tells you to do so, you are to open your test to the first page of the Woodwork section. Read the directions carefully, then answer as many of the questions as you can. Answers are to be placed on the separate answer sheet in the parenthesis to the right of the appropriate question number. Start by doing the easy questions as you work through Section one, then go back and do the more difficult ones. DO NOT Proceed to the next section until you are told to do so. When the time is up your teacher will say "Stop". Put down your pencil and await the next instruction.

PLACE ALL ANSWERS ON SEPARATE SHEET.

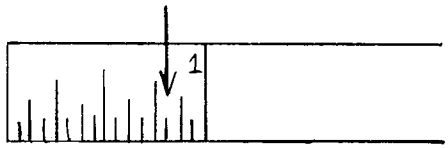
WOODWORK

Directions: Each of the questions below is followed by several choices. Select the best answer and put its number in the parenthesis (brackets) which follow the question number on the answer sheet.

Example: I. Hardwood trees have (1) cones, (2) needles, (3) broad leaves, (4) wood which is very hard [I. (3)]

"Have broad leaves" is the correct answer. As it is the answer numbered (3), the number 3 has been written in the parenthesis.

1. The wood of a softwood tree is (1) soft, (2) hard, (3) porous, (4) sometimes harder than hardwood.
2. A tree which is a hardwood is (1) Douglas fir, (2) white pine, (3) red cedar, (4) coast maple.
3. The hand saw which should be used to saw with the grain is (1) back, (2) rip, (3) cross cut, (4) coping.
4. Rip saw teeth are shaped like (1) cones, (2) knives, (3) axes, (4) chisels.
5. The cutting points of cross cut saw teeth are shaped like (1) chisels, (2) knives, (3) axes, (4) needles.
6. The purpose of the plane iron is to (1) prevent "chatter", (2) curl the shaving, (3) sever the shaving, (4) hold double iron in place.
7. The purpose of the plane cap iron is to (1) stiffen, (2) curl the shaving (3) sever the shaving, (4) hold double iron in place.
8. The principle of the cutting action of the plane iron is that of (1) wedge, (2) inclined plane, (3) lever, (4) wheel and axle.
9. When held correctly, a marking gauge is used (1) head tilted, pin trailing, (2) head upright, pin vertical, (3) head upright, pin horizontal, (4) head tilted, pin extended at least 1/4".
10. The graduations found on most bench rules are (1) multiples of sixteenths, (2) eighths, (3) twelfths, (4) tenths.

11. 

The measurement indicated by the arrow is (1) 5/8, (2) 3/4, (3) 13/16 (4) 7/8.

12. A try square is abused when used for (1) measuring (2) testing, (3) depth gauge, (4) tapping.

13. A marking knife is used (1) to get accurate layout lines across the grain (2) to mark with the grain, (3) in preference to pencil (4) when line is not removed by later tool action.

14. In laying out duplicate parts (1) care must be taken, (2) all pieces are clamped together and laid out at the same time, (3) each piece is carefully laid out from drawing, (4) use duplicate gauge for layout.

15. To ensure safety a chisel is held (1) firmly, (2) tightly in both hands, (3) one hand firmly - other as a guide, (4) at a slight angle to the cut.

16. When chiselling a mallet is used (1) for vertical chiseling (2) if chisel is dull (3) for horizontal chiselling (4) for heavy cuts.

17. Dull chisels (1) are easier to control as they cut more slowly, (2) are found in every shop, (3) can be identified by light reflected from the edge, (4) are hollow ground.

18. The tang of a chisel is (1) fitted into the socket, (2) fitted into the handle, (3) a swelled cup shape at the end of the blade, (4) necessary for safety.

19. A number 6 on an auger bit indicates a bit diameter of (1) 1/4", (2) 3/8", (3) 1/2", (4) 3/4".

20. The auger bit gauge is used (1) to hold auger bit for sharpening, (2) to find out size of bit, (3) as a depth gauge, (4) to measure cutting angles for sharpening.

21. The most suitable tool for shaping a curved surface is (1) knife, (2) spokeshave, (3) plane, (4) chisel.

22. Chattering when using a spokeshave usually indicates that (1) too much blade is exposed, (2) blade is barely exposed, (3) stroke is too fast, (4) too much pressure is applied.

23. Wood files are used (1) only when edge tool will not do as good a job, (2) when a quick job is wanted, (3) when a fine edge is wanted, (4) by amateurs.

24. To ensure safety, a file must be (1) chalked, (2) oiled, (3) fitted with a handle, (4) placed in a rack.

25. The simplest joint is (1) closed housing, (2) open housing, (3) butt joint, (4) cross lap joint.

26. A joint more suitable for nailing than gluing is (1) butt, (2) closed housing, (3) open housing, (4) cross lap.

27. Another name for a stopped dado is (1) cross lap joint, (2) butt joint, (3) open housing joint, (4) closed housing joint.

28. The best tool for levelling a dado to depth is (1) chisel, (2) gauge, (3) router plane, (4) forstner bit.

29. A stopped housing is used in preference to an open housing to secure, (1) greater strength, (2) better appearance, (3) greater utility, (4) greater versatility.

30. The most suitable length of nail for fastening a butt joint having a cover piece 3/4" thick is (1) 3/4", (2) 1. 1/4", (3) 2. 1/4", (4) 3".

31. Nails are driven on an angle because (1) it is easier, (2) they are not so liable to bend, (3) they last longer, (4) they have better holding power.

32. The best type of abrasive for woodwork is (1) flint, (2) garnet, (3) emery, (4) sand.

33. A suitable grade of abrasive paper for sanding "between coats" is (1) 1/2 - 60, (2) 0 - 80, (3) 3/0 - 120, (4) 6/0 - 220.

34. A suitable grade of abrasive paper for "cleaning up" before finishing is (1) 1. 1/2 - 40, (2) 1/2 - 80, (3) 3/0 - 120 (4) 6/0 - 220.

35. As a general rule, never use abrasive paper (1) with the grain, (2) across the grain, (3) with a sanding block, (4) with too fine a grade of abrasive.

36. Splitting is prevented when planing end grain by (1) planing 2/3 across from each side, (2) having plenty of blade exposed, (3) clamping work tightly in vise, (4) planing from centre outward.

37. A saw kerf (1) grazes the cut line, (2) grazes the pencil line, (3) is made in the waste wood, (4) grazes the waste side of the layout line.

38. The face edge mark indicates (1) a true surface at 90° to face side, (2) a planed edge, (3) a true surface opposite the face side, (4) that the project has been made in a school shop.

39. The type of nail suitable for rough unfinished work is (1) common, (2) finishing, (3) cigar box, (3) escutcheon.

40. A nail suitable for cabinet work and butt joints in project making (1) common, (2) finishing, (3) cigar box, (4) escutcheon.

41. Common nails are usually made from (1) mild steel, (2) carbon steel, (3) aluminum, (4) copper.

42. The gauge number of a screw refers to the (1) diameter of shank, (2) length, (3) number of threads, (4) number in a box.

43. The correct amount of the threaded part of a screw to drive into the second board is (1) 1/4, (2) 1/2, (3) 3/4, (4) all of it.

44. A flat head screw in soft wood requires (1) a pilot hole, (2) countersink hole, (3) shank hole, (4) shank and countersink holes.

45. Glue is spread (1) evenly on all contacting surfaces of a joint, (2) evenly on one of the contacting surfaces, (3) thickly over all surfaces of the joint, (4) thickly on one of the contacting surfaces.

46. "Dry clamping ensures (1) a strong joint, (2) no excess glue on finished surface, (3) that work can be assembled properly, (4) that the clamps work properly.

47. Clamps are applied to a project which has been glued to ensure (1) that glue will dry rapidly, (2) glue will cure properly, (3) correct alignment of parts when glue dries, (4) that the joint will not be unsightly.

48. A suitable temperature for most shop gluing is (1) 60°, (2) 70°, (3) 80°, (4) 90°.

49. Finishing brushes are cleaned in (1) gasoline, (2) brush cleaner, (3) paint remover, (4) correct solvent for material used.

50. The teeth of a scroll saw are intended to cut on (1) down stroke, (2) upstroke, (3) both up and down stroke, (4) any direction. . . . . .

METALWORK

Directions: Each of the questions below is followed by several choices. Select the best answer and put its number in the parenthesis.

51. Band iron is (1) mild steel, (2) medium carbon steel, (3) carbon tool steel, (4) complex alloy steel.

52. The Beverly Shear is never used to cut (1) black iron plate, (2) sheet aluminum, (3) galvanized iron, (4) wire.

53. The correct number of teeth for a hacksaw blade used to cut 1/2" round mild steel is (1) 14, (2) 18, (3) 24, (4) 32.

54. When band iron is bent an allowance must be added when calculating, to allow for (1) shrinkage, (2) stretch, (3) compression, (4) tension.

55. Before using a cold chisel with a mushroomed head (1) get permission, (2) put on face shield, (3) get permission to grind head back to normal, (4) use reasonable care.

56. 1/16 black iron sheet may be shear cut with (1) cold chisel, (2) tin snips, (3) hack saw, (4) band saw.

57. When stock 1/8 x 3/4 is to be sawed with hacksaw blade horizontal (1) saw across the narrowest surface, (2) saw across the widest surface, (3) saw diagonally across, (4) use a 24 tooth saw and saw anywhere.

58. The most useful hammer for general metal use is (1) tinner's, (2) claw, (3) blacksmith, (4) ball pein.

59. The two matched parts of the Whitney Punch are (1) tap and die, (2) punch and die, (3) punch and set, (4) die and set.

60. The mechanical principle of the Whitney Punch is (1) simple lever, (2) compound lever, (3) triple lever, (4) quadruple lever.

61. $1\frac{1}{2}$ lb. tinners' rivets (1) weight $1\frac{1}{2}$ lb. per 1000, (2) weigh $1\frac{1}{2}$ lb. per 100, (3) weigh $1\frac{1}{2}$ lb. each, (4) originally cost $1\frac{1}{2}$ pounds (English money) per thousand.

62. The commonest way to make a hole for a tinner's rivet in tinplate is (1) drill hole, (2) Whitney Punch, (3) prick punch, (4) punch rivet through with rivet set.

63. The best file to use for rapid removal of mild steel stock is (1) single cut smooth, (2) single cut bastard, (3) double cut smooth, (4) double cut bastard.

64. The most important reason for equipping files with handles is that (1) it is a school rule, (2) it results in better work, (3) it results in faster work, (4) handles offer protection.

65. Racks are provided for files (1) to prevent damage to file teeth, (2) for improved appearance, (3) for safety, (4) for easy checking.

66. Chemical cleaning of a soldering copper involves the use of heat and (1) solder, (2) sal ammoniac, (3) file, (4) tin.

67. Physical cleaning of a soldering copper involves the use of (1) solder, (2) sal ammoniac, (3) file, (4) tin.

68. Soft solder is composed of (1) tin and lead, (2) tin and zinc, (3) lead and zinc, (4) lead, tin and zinc.

69. The soldering copper is a device used to (1) transfer heat, (2) melt the solder, (3) melt the flux, (4) hold solder.

70. When soldering, the soldering copper is moved slowly along the joint in order to (1) let the solder flow, (2) bring the metal to the same temperature as the iron, (3) melt the flux, (4) prevent exidation.

71. Resin core solder is a must for (1) electrical joints, (2) tin plate, (3) copper, (4) galvanized iron.

72. Flux is used to (1) economize on the use of solder, (2) physically clean the surface, (3) cause rapid heat penetration, (4) prevent or dissolve exidation.

73. The correct forging temperature for mild steel is indicated by (1) bright yellow color, (2) cherry red color, (3) dull red color, (4) whitish color.

74. Carbon steel may be identified by (1) torpedo shaped spark, (2) bomblike radial sparks, (3) bomb like radial sparks mixed with torpedo shaped sparks, (4) dull broken line type sparks.

75. The percentage of carbon in carbon tool steel is about (1) .10% to .5% (2) between .5 and 1.5%, (3) 10 to 15%, (4) 15%.

76. The percentage of carbon in mild steel is (1) .10 to .30%, (2) between .60% and 1.30%, (3) 10%, (4) 13%.

77. The process of normalizing (1) tempers carbon tool steel, (2) removes the strains of forging, (3) hardens the steel, (4) case hardens the steel.

78. The correct hardening temperature for carbon steel is reached when the metal is (1) non-magnetic, (2) at white heat, (3) at dull red heat, (4) straw color.

79. Tool steel is hardened by heating it to the correct temperature and (1) cooling it in the furnace, (2) quenching in oil or water, (3) cooling it by placing in sand, (4) cooling slowly in air.

80. The correct area of a grinding wheel, for general purposes, to use is (1) face, (2) face and left side, (3) face and right side, (4) any exposed surface.

81. A reasonable clearance between tool rest and face of grinding wheel is (1) 1/8" or less, (2) 3/16", (3) 1/4", (4) 5/16" or more.

82. When using a grinder, (1) goggles need not be worn, (2) goggles may be worn, (3) goggles must be worn, (4) use your own discretion about wearing goggles.

83. A countersink is used to (1) true up a drilled hole, (2) prepare a hole to receive a flat head rivet or bolt, (3) counterbore, (4) make a pilot hole.

84. Generally speaking large drills are operated at (1) high speed, (2) medium speed, (3) low speed, (4) any speed is satisfactory.

85. A coolant for use when drilling is (1) cutting oil, (2) lube oil (3) thread oil, (4) gear oil.

86. The correct placing of the drill press belt for lowest speed is (1) largest motor pulley to smallest spindle pulley, (2) smallest motor pulley to largest spindle pulley, (3) largest motor pulley to largest spindle pulley, (4) smallest motor pulley to smallest spindle pulley.

87. Work being drilled at the drill press is (1) held closely to the tool rest, (2) held in one's hand, (3) held by means of a clamping device, (4) clamped because it is a shop rule.

88. Danger in grinding small objects arises through (1) object overheating, (2) object slipping between wheel and rest, (3) carelessness only, (4) nervousness of operator.

89. Final hand polishing of mild steel is done by (1) draw-filing, (2) 240 grit abrasive and oil, (3) 240 grit abrasive, (4) 80 grit abrasive and oil.

90. Metal projects are coated (paint etc.) to (1) prevent corrosion, (2) improve appearance, (3) get a higher mark, (4) prevent corrosion and improve appearance.

Match the terms found in the left-hand column with the statements found at the right. Place the number appearing before the term in the parenthesis

1. Accuracy
2. Ball pein
3. Dividers
4. Double hem
5. Drawfiling
6. Mild steel
7. Sal ammoniac
8. Single cut
9. Single hem
10. Soft solder
11. Spark test
12. Double Cut

91. a file with a single row of teeth
92. A process which results in a finished surface.
93. used for "tin cans"
94. used to chemically clean soldering iron
95. machinist hammer
96. quick cutting file
97. used in layout of circles
98. used to identify tool steel
99. used to tin a chemically clean soldering iron
100. sheet metal having one folded edge.

STOP

END OF SECTION ONE

DO NOT PROCEED UNLESS TEST IS BEING

TAKEN IN ONE SITTING.

ELECTRICITY

Directions: Each of the questions below is followed by several choices. Select the best answer and put its number in the parenthesis, on answer sheet.

101. The best known conductor of electricity is (1) silver, (2) gold, (3) copper, (4) tungsten.

102. A good non-conductor is (1) iron, (2) plastic, (3) aluminum, (4) tungsten.

103. The name of a device used to transform electricity to another form of energy is (1) lamp, (2) voltmeter, (3) generator, (4) dry cell.

104. The unit by which the rate of electron flow is measured is the (1) volt, (2) ampere, (3) ohm, (4) watt.

105. A negatively charged particle of electricity is called (1) electron, (2) proton, (3) neutron, (4) atom.

106. The direction of flow of electrons in a circuit is from (1) positive terminal to negative terminal, (2) north pole to south pole, (3) negative terminal to positive terminal, (4) south pole to north pole.

107. The movement of electrons from one atom to another in a conductor is called (1) current, (2) voltage, (3) resistance, (4) load.

108. An atom which is negatively charged has (1) excess electrons, (2) excess protons, (3) excess neutrons, (4) shortage of electrons.

109. The correct way to connect an ammeter into a circuit is (1) in series, (2) in parallel, (3) across the circuit, (4) series-parallel.

110. The instrument used to measure current flow is (1) ammeter, (2) voltmeter, (3) ohmeter, (4) hydrometer.

111. The unit of potential difference is (1) ohm, (2) volt, (3) ampere, (4) electron.

112. A device which converts chemical energy to electrical energy is (1) dry cell, (2) generator, (3) photo cell, (4) crystal pick-up.

113. The crystal pick-up on a record player depends for its operation on (1) chemical action, (2) piezoelectric effect, (3) light, (4) heat.

114. An increase in the size of electrodes in primary cells results in greater (1) voltage, (2) current, (3) resistance, (4) usefulness.

115. Polarization of a primary cell results in (1) greater efficiency, (2) deposits of nitrogen gas on positive electrode, (3) increased current, (4) decreased voltage.

116. Storage cells (1) are more readily discharged than dry cells, (2) may be recharged many times, (3) are cheaper for the same voltage, (4) cannot be recharged as readily as dry cells.

117. A storage cell stores (1) electrical energy, (2) chemical energy, (3) physical energy, (4) kinetic energy.

118. Suitable plates for a simple storage cells are (1) lead plates, (2) 1 lead plate, 1 copper plate, (3) zinc plates, (4) 1 carbon plate, 1 zinc plate.

119. The voltage of dry cells connected in series is (1) sum of voltage of combined cells, (2) product of voltage of combined cells, (3) same as one cell, (4) 3 volts.

120. When measuring with a voltmeter in a circuit the instrument is (1) connected in series, (2) connected in parallel, (3) connected in series-parallel, (4) connected 'in' the line.

121. The instrument used to measure potential difference in a circuit is (1) ammeter, (2) voltmeter, (3) ohmeter, (4) pressure gauge.

122. Resistance in a circuit is (1) opposition to the flow of current, (2) very harmful, (3) increased by using wires of larger size, (4) lessened by raising the temperature.

123. Resistance is measured in (1) volts, (2) ohms, (3) amperes, (4) farads.

124. A conducting path would have greatest resistance if made of (1) copper, (2) iron, (3) nichrome, (4) aluminum.

125. Increasing the length of the conductor causes (1) increase in voltage, (2) no decrease in voltage, (3) increase in current, (4) increase in resistance.

126. Material suitable for a heating element is (1) copper, (2) iron, (3) nichrome, (4) aluminum.

127. A short circuit occurs when there is (1) high resistance, (2) practically no resistance, (3) low voltage, (4) high voltage.

128. A hotplate having a resistance of 20 ohms is plugged into a 110 volt circuit, the current flowing in the circuit is (1) 5.5 amps, (2) 1.5 amps, (3) 55 amps, (4) 155 amps.

129. A flashlight lamp is connected to a $1\frac{1}{2}$ volt dry cell and uses .1 amps of current, the resistance of the lamp is (1) 15 ohms, (2) 1.5 ohms, (3) .15 ohms, (4).015 ohms.

130. The number of paths offered in a series circuit is (1) 1, (2) 2, (3) 2 or more, (4) at least 3.

131. The number of paths offered in a parallel circuit is (1) 1, (2) 2, (3) 2 or more, (4) at least three.

132. The correct wire to use for an electric iron is (1) heater cord, (2) lamp cord, (3) #14 2 wire loomex, (4) annunciator wire.

133. Worn extension cords are dangerous because (1) danger from short circuit, (2) may blow fuse, (3) may not be able to use portable equipment when wanted, (4) they are unsightly.

134. The plug on an extension cord is removed from a convenience outlet by (1) pulling on the wire, (2) grasping plug and pulling it until it releases, (3) use a plug ejector, (4) whip it out by snapping on cord.

135. The most serious result of attempting to remove a plug from an ungrounded convenience outlet while holding a water tap could be (1) nothing at all, (2) a shock, (3) a burn, (4) death.

Directions: Each of the following statements describes one of the terms listed below. In the brackets, on the answer sheet, place the number of the term described.

(1) Ampere

(2) Circuit

(3) Conductor

(4) Current

(5) Insulator

(6) Ion

(7) Ohm

(8) Resistance

(9) Switch

(10) Volt.

136. The unit of measure for a specific flow of electrons

137. A charged atom what contains more or less than its normal number of electrons.

138. The unit of electrical resistance

139. The unit of electromotive force

140. A device used to open or close a circuit.

141. A solid, liquid or gas through which the electrons pass easily.

142. The movement of electrons through a conductor.

143. The complete path of an electric current.

Directions: Each of the following terms describes one of the electrical symbols illustrated below. In the brackets, on the answer sheet, place the number of the term described.

(1) Ammeter

(2) Atom

(3) Buzzer

(4) Cells in parallel

(5) Cells in series

(6) Ground

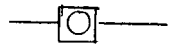
(7) Lamps in parallel

(8) Push button

(9) Tap splice.

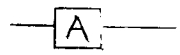
144. 

145. 

146. 

147. 

148. 

149. 

150. 

DRAFTING.

Directions: Each of the following free-hand drawing statements is related to a term or phrase in the list below. In the brackets, on the answer sheet, place the number of the term or phrases described.

(1) Accurate proportions
(2) Circle
(3) Ellipse
(4) Horizontal line
(5) Oblique projection
(6) Pencil
(7) Perspective
(8) Secret of sketching
(9) Squared paper
(10) Straight line
(11) Value of sketch
(12) Vertical line

151. Inscribed within a square
152. An aid to good sketching
153. Drawn from left to right
154. Quick method of producing a graphic illustration.
155. Drawn progressively in short steps.
156. Necessary for a good sketch.
157. Drawn from top to bottom.
158. Draw large areas first.
159. Device which can be used to estimate proportions.
160. Drawn within enclosing rectangle.

Directions: Each of the following statements describes one of the drafting terms listed at the left. In the brackets on the answer sheet, place number of the term described.

(1) Cavalier oblique
(2) Center line
(3) Dimension increment
(4) Front view
(5) Isometric projection
(6) Leader line
(7) Notation
(8) Orthographic projection.
(9) Pictorial drawing
(10) Reduced scale drawing
(11) Stretchout
(12) Top view

161. Has length and height
162. Depth of pictorial view is full size.
163. Used in conjunction with notations.
164. $\frac{1}{4}$ drill - 2 holes
165. House plan, or other large object
166. $\frac{1}{4}$" on small drawings.
167. Consists of top view, front view and side views as required.
168. Has length and width
169. Sheet metal development.
170. Perspective drawing.

Directions: Each of the following operations may be performed best by using one of the pencils listed below. In the brackets on the answer sheet, place the number of the correct pencil to use to perform the operation.

(1) 4 H

(2) 4 B

(3) H B

(4) 6 H

171. Cutting plane line

172. Arrow heads

173. Extension lines

174. Dimension figures

175. Notations

Directions: Arrange the following steps of dimensioning procedure in the correct order of working. Place the capital letter which appears before step one in the appropriate space which is found on the answer sheet. Continue with the remainder in their appropriate order.

A. Arrow Heads

B. Dimension figures

C. Dimension line

D. Notations

E. Extension lines

176. Step 1

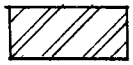
177. Step 2

178. Step 3

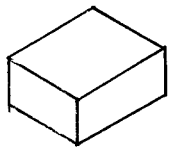
179. Step 4

180. Step 5

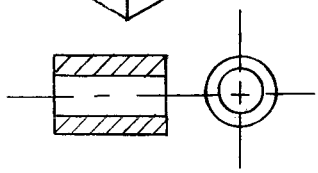
Directions: Each of the following drafting terms describes one of the sketches found below. In the brackets on the answer sheet, place the number of the term described in the sketch.

(1) 

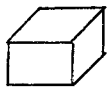
181. Isometric projection

(2) 

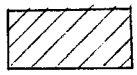
182. Oblique projection

(3) 

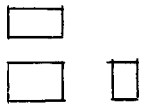
183. Orthographic projection

(4) 

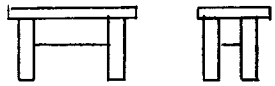
184. Envelope

(5) 

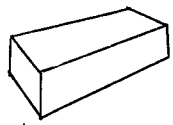
185. Perspective drawing

(6) 

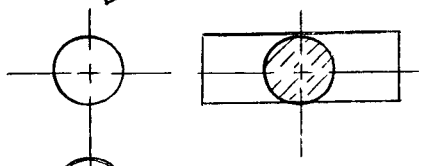
186. Section line for steel

(7) 

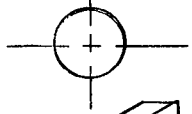
187. Scale drawing

(8) 

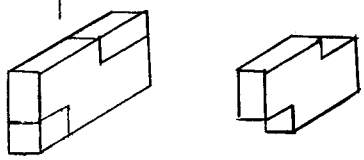
188. Revolved section

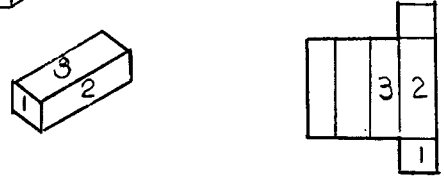
(9) 

189. Full section

(10) 

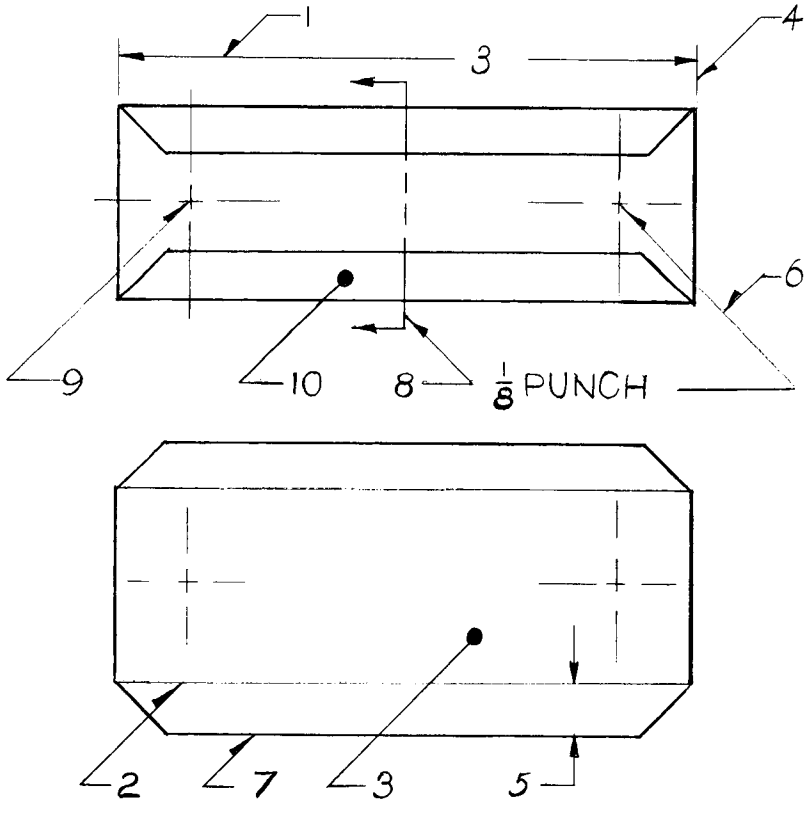
190. Parallel line development.

(11) 

(12) 

Directions: Each of the drafting terms listed below is to be found identified by numbers on appropriate parts of the sketch. In the brackets on the answer sheet, place the number of the part described.

191. Body line
192. Fold line
193. Center line
194. Single hem
195. Stretchout
196. Cutting plane line
197. Dimension line
198. Extension line
199. Leader line
200. Hem allowance.



Name_____ Date_____ Industrial Education 8

School_____ City_____ Answer Sheet

Birthday_____ Age_____

Month Day Year Last birthday

Woodwork (1-50)		Metalwork (51-100)		Electricity (101-150)		Drafting (151-200)	
1.(4)	26.(1)	51.(1)	76.(1)	101.(1)	126.(3)	151.(2)	176.(E)
2.(4)	27.(4)	52.(4)	77.(2)	102.(2)	127.(2)	152. (9)	177.(C)
3.(2)	28.(3)	53.(2)	78.(1)	103.(1)	128.(1)	153.(4)	178.(A)
4.(4)	29.(2)	54.(1)	79.(2)	104.(2)	129.(1)	154.(11)	179.(B)
5.(2)	30.(3)	55.(3)	80.(1)	105.(1)	130.(3)	155.(10)	180.(D)
6.(3)	31.(4)	56.(1)	81.(1)	106.(3)	131.(3)	156.(1)	181.(2)
7.(2)	32.(2)	57.(2)	82.(3)	107.(1)	132.(1)	157.(12)	182.(4)
8.(1)	33.(4)	58.(4)	83.(2)	108.(1)	133.(1)	158.(8)	183.(6)
9.(1)	34.(3)	59.(2)	84.(3)	109.(1)	134.(2)	159.(6)	184.(11)
10.(1)	35.(2)	60.(2)	85.(1)	110.(1)	135.(4)	160.(3)	185.(8)
11.(3)	36.(1)	61.(1)	86.(2)	111.(2)	136.(1)	161.(4)	186.(1)
12.(4)	37.(4)	62.(4)	87.(3)	112.(1)	137.(6)	162.(1)	187.(7)
13.(1)	38.(1)	63.(4)	88.(2)	113.(2)	138.(7)	163.(6)	188.(9)
14.(2)	39.(1)	64.(4)	89.(2)	114.(2)	139.(10)	164.(7)	189.(3)
15.(3)	40.(2)	65.(1)	90.(4)	115.(4)	140.(9)	165.(10)	190.(12)
16.(4)	41.(1)	66.(2)	91.(8)	116.(2)	141.(3)	166.(3)	191.(7)
17.(3)	42.(1)	67.(3)	92.(5)	117.(2)	142.(4)	167.(8)	192.(2)
18.(2)	43.(4)	68.(1)	93.(6)	118.(1)	143.(2)	168.(12)	193.(9)
19.(2)	44.(4)	69.(1)	94.(7)	119.(1)	144.(9)	169.(11)	194.(10)
20.(3)	45.(1)	70.(2)	95.(2)	120.(2)	145.(5)	170.(9)	195.(3)
21.(2)	46.(3)	71.(1)	96.(12)	121.(2)	146.(8)	171.(3)	196.(8)
22.(1)	47.(3)	72.(4)	97.(3)	122.(1)	147.(6)	172.(3)	197.(1)
23.(1)	48.(2)	73.(2)	98.(11)	123.(2)	148.(7)	173.(1)	198.(4)
24.(3)	49.(4)	74.(2)	99.(10)	124.(3)	149.(1)	174.(1)	199.(6)
25.(3)	50.(1)	75.(2)	100.(9)	125.(4)	150.(3)	175.(3)	200.(5)

APPENDIX C.
ITEM ANALYSIS OF TEST QUESTIONS

	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{S. Diff.}$
1	55	16.08	47	13.74	2.34	3.53	.66
2	252	73.68	201	58.77	13.91	3.57	3.89
3	244	71.34	172	50.29	21.05	3.64	5.78
4	237	69.29	185	54.09	15.20	2.94	3.85
5	288	84.20	134	39.18	45.02	3.28	13.72
6	80	23.39	-66	19.29	4.10	3.11	1.31
7	55	16.08	46	13.44	2.64	2.70	.97
8	172	50.29	132	38.59	11.70	3.69	3.17
9	245	71.63	166	48.53	23.10	3.64	6.34
10	220	64.32	199	58.18	6.14	3.71	1.65
11	321	93.85	300	87.71	6.14	1.6	4.47
12	129	37.71	157	45.90	-8.19	--	--
13	224	65.49	177	51.75	13.74	3.72	3.69
14	126	36.84	83	24.26	12.58	3.48	3.61
15	165	48.24	183	53.50	-5.26	--	--
16	194	56.72	190	55.55	1.17	3.79	.31
17	251	73.38	146	42.68	30.70	3.59	8.55
18	248	72.51	203	59.35	13.16	3.59	3.67
19	154	45.02	114	33.33	11.69	3.70	3.15
20	65	19.00	61	17.83	1.36	2.96	.46
21	225	65.78	154	45.02	20.76	3.71	5.59
22	214	62.57	148	43.27	19.3	3.74	5.16
23	89	26.02	65	19.00	7.02	3.17	2.21
24	287	83.91	221	64.61	19.30	3.25	5.9
25	175	51.16	101	29.53	21.63	3.65	5.92
26	140	40.93	98	28.65	12.28	3.6	3.39
27	190	55.55	127	37.13	18.42	3.74	4.92
28	201	58.77	172	50.29	8.48	3.79	2.23
29	111	32.45	63	18.42	14.02	3.28	4.27
30	72	21.05	38	11.11	9.94	2.77	3.58
31	320	93.56	297	86.83	6.73	2.23	3.01
32	175	51.16	152	44.44	6.72	3.61	1.86
33	131	38.30	94	27.48	10.82	3.56	3.04
34	111	32.45	78	22.80	9.65	3.39	2.84
35	278	81.28	220	64.32	16.96	3.33	5.09
36	185	54.09	126	36.84	17.25	3.74	4.61
37	153	44.73	131	38.30	6.43	3.75	1.71
38	206	60.23	111	32.45	27.78	3.66	7.50
39	277	80.99	191	55.84	25.15	3.41	7.37
40	283	82.74	206	60.23	22.51	3.34	6.73

	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{\text{S. Diff.}}$
41	267	78.06	199	58.18	19.88	3.47	5.72
42	219	64.03	142	41.51	22.52	3.71	6.07
43	60	17.54	74	21.63	-4.09	--	--
44	84	24.56	69	20.17	4.39	3.18	1.38
45	245	71.63	150	43.85	27.78	3.6	7.71
46	72	21.05	50	14.61	6.44	2.91	2.21
47	247	72.22	145	42.39	29.83	3.60	8.28
48	244	71.34	185	54.09	17.25	3.64	4.73
49	291	85.08	200	58.47	26.61	3.26	8.16
50	149	43.56	96	28.06	15.50	3.61	4.29
51	198	57.89	140	40.93	16.96	3.76	4.51
52	175	51.16	104	30.40	20.76	3.47	5.98
53	97	28.36	102	29.82	-1.46		
54	74	21.63	56	16.37	5.26	2.99	1.75
55	224	65.49	139	40.64	24.85	3.69	6.73
56	74	21.63	49	14.32	7.31	2.91	2.51
57	71	75	64	18.71	2.04	3.03	.67
58	314	91.81	261	76.31	15.50	2.73	5.67
59	223	65.20	138	40.34	24.86	3.69	6.73
60	147	42.98	107	31.28	11.70	3.66	3.19
61	171	49.99	114	33.33	16.66	3.71	4.49
62	15	4.38	35	10.23	-5.85		
63	252	73.68	204	59.64	14.04	3.56	3.94
64	315	92.10	284	83.03	9.07	2.49	3.64
65	189	55.26	167	48.82	6.44	3.81	1.69
66	318	92.98	232	67.83	25.15	2.87	6.49
67	287	83.91	170	49.70	34.21	3.35	10.21
68	220	64.32	164	47.95	16.37	3.74	4.37
69	108	31.57	94	27.48	4.09	3.48	1.17
70	103	30.11	71	20.75	9.36	3.30	2.83
71	193	56.43	142	41.51	15.92	3.77	4.22
72	113	33.04	53	15.49	17.55	3.20	5.48
73	177	51.75	144	42.10	9.65	3.79	2.54
74	74	21.63	44	12.86	8.77	2.87	3.05
75	87	25.43	65	19.00	6.43	3.16	2.03
76	125	36.54	92	26.89	9.65	3.53	2.73
77	148	43.27	94	27.48	15.79	3.60	4.38
78	101	29.53	67	19.59	9.94	3.26	3.04
79	237	69.29	180	52.63	16.66	3.67	4.53
80	231	67.54	131	38.30	29.24	3.64	8.03

	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{\text{S. Diff.}}$
81	143	41.81	107	31.28	10.53	3.65	2.88
82	282	82.45	255	74.55	7.90	3.12	2.53
83	269	78.65	221	64.61	14.04	3.32	4.22
84	199	58.18	75	21.92	36.26	3.72	9.74
85	178	52.04	107	31.28	20.76	3.68	5.64
86	186	54.38	80	23.39	30.99	3.53	8.77
87	307	89.76	254	74.26	15.50	2.87	4.00
88	194	56.72	158	46.19	10.53	3.79	2.77
89	104	30.40	67	19.59	10.81	3.28	3.29
90	267	78.06	216	63.15	14.91	3.21	4.64
91	319	93.27	249	72.80	20.47	2.75	7.44
92	265	77.48	163	47.65	29.83	3.51	8.49
93	112	32.74	82	23.97	8.77	3.32	2.64
94	313	91.51	201	58.77	32.74	3.06	10.69
95	323	95.90	260	76.02	19.88	2.53	5.63
96	311	90.93	212	61.98	28.95	3.04	9.52
97	302	88.30	249	72.80	15.50	2.86	5.41
98	299	87.42	182	53.21	34.21	3.23	10.59
99	209	61.10	101	29.53	31.59	3.60	8.77
100	299	87.42	205	59.93	27.49	3.19	8.61
101	181	52.92	126	36.84	16.08	3.74	4.29
102	303	88.59	252	73.68	14.91	2.92	5.10
103	131	38.30	45	13.15	25.15	3.19	7.88
104	159	46.49	117	34.20	12.29	3.72	3.30
105	140	40.93	111	32.45	8.48	3.66	2.31
106	197	57.60	147	42.98	14.62	3.78	3.86
107	283	82.74	232	67.83	14.91	3.24	4.60
108	107	31.28	61	17.83	13.45	3.24	4.15
109	150	43.85	137	40.05	3.80	3.76	1.01
110	279	81.57	126	36.84	44.73	3.34	13.39
111	73	21.34	48	14.03	7.31	2.90	2.52
112	204	59.64	133	38.88	20.76	3.74	5.55
113	258	75.43	190	55.55	19.88	3.55	5.59
114	81	23.68	61	17.83	5.85	3.09	1.89
115	130	38.01	91	26.60	11.41	3.54	3.22
116	245	71.63	164	47.95	23.68	3.63	6.52
117	143	41.81	114	33.33	8.48	3.68	2.30
118	124	36.25	77	22.51	13.74	3.44	3.99
119	224	65.49	140	40.93	24.56	3.69	6.65
120	116	33.91	111	32.45	1.46	3.59	.40

	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{\text{S. Diff.}}$
121	62	18.2	61	17.83	.37	2.93	.12
122	245	71.63	159	46.49	25.15	3.63	6.92
123	251	73.38	158	46.19	27.19	3.60	7.55
124	155	45.32	97	28.36	16.96	3.62	4.68
125	230	67.24	126	36.84	30.40	3.63	8.37
126	156	45.61	79	23.09	22.52	3.52	6.39
127	111	32.45	79	23.09	9.38	3.40	2.75
128	185	54.09	111	32.45	21.64	3.69	5.86
129	66	19.29	50	14.61	4.68	2.85	1.64
130	98	28.65	97	28.36	.29	3.38	--
131	97	28.36	85	24.85	3.51	3.37	1.04
132	167	48.82	120	35.08	13.74	3.73	3.68
133	301	88.00	240	70.17	17.83	3.03	5.88
134	298	87.13	229	66.95	20.18	3.12	6.46
135	271	79.23	205	59.93	19.30	3.43	5.62
136	179	52.33	89	26.02	26.31	3.57	7.36
137	208	60.81	73	21.34	39.47	3.44	11.47
138	252	73.68	105	30.70	42.98	3.44	12.49
139	174	50.87	61	17.83	33.04	3.40	9.71
140	329	96.19	240	70.17	26.02	2.67	7.08
141	280	81.86	122	35.67	46.19	3.31	13.95
142	259	75.72	126	36.84	38.88	3.48	11.17
143	295	86.25	185	54.09	32.16	3.27	9.83
144	206	60.23	84	24.56	35.67	3.52	10.13
145	122	35.67	63	18.42	17.25	3.29	5.24
146	231	67.54	140	40.93	26.61	3.66	7.27
147	130	38.01	46	13.44	24.57	3.20	7.67
148	198	57.89	106	30.99	26.90	3.66	7.35
149	263	76.89	140	40.93	35.96	3.48	10.33
150	130	38.01	55	16.08	21.93	3.28	6.68
151	75	21.92	37	10.81	11.11	2.78	3.99
152	64	18.71	34	9.94	8.77	2.65	3.30
153	203	59.35	147	42.98	16.37	2.96	5.53
154	30	8.77	24	7.01	1.71	2.05	.83
155	19	5.55	15	4.38	1.17	1.65	.70
156	67	19.59	59	17.25	2.34	2.96	.79
157	234	68.41	180	52.63	15.78	3.69	4.27
158	93	27.19	48	14.03	13.16	3.04	4.32
159	52	15.20	26	7.60	7.60	2.40	3.16
160	94	27.48	47	13.74	13.74	3.05	4.50

	N_1	P_1	N_2	P_2	P_1-P_2	S. Diff.	$\frac{P_1-P_2}{\text{S. Diff.}}$
161	182	53.21	127	37.13	16.08	3.75	4.28
162	34	9.94	13	3.80	6.14	1.91	3.2
163	75	21.93	37	10.81	11.12	2.79	3.98
164	71	20.75	32	9.35	11.40	2.69	4.08
165	157	45.90	83	24.26	21.64	3.55	6.09
166	83	24.26	38	11.11	13.15	2.87	4.58
167	141	41.26	94	22.48	18.78	3.48	5.39
168	142	41.51	79	23.09	18.42	3.50	7.36
169	68	19.88	41	11.98	7.90	2.77	2.85
170	65	19.00	40	11.69	7.31	2.73	2.67
171	90	26.31	89	26.02	.29		
172	129	37.71	92	26.89	10.82	3.54	3.05
173	143	41.51	88	25.73	15.78	3.55	4.44
174	104	30.40	73	21.34	9.06	3.32	2.72
175	160	46.78	119	34.79	11.99	3.72	3.22
176	163	47.65	74	21.63	26.02	3.49	7.45
177	167	48.82	123	35.96	12.86	3.74	3.43
178	119	34.79	61	17.83	16.96	3.30	5.13
179	120	35.08	60	17.54	17.54	3.29	5.33
180	202	59.06	124	36.25	22.81	3.71	6.14
181	116	33.91	60	17.54	16.37	3.28	4.99
182	98	28.65	40	11.69	16.96	2.99	5.67
183	112	32.74	54	15.78	16.96	3.21	5.28
184	47	13.74	18	5.26	8.48	2.21	3.83
185	120	35.08	40	11.69	23.39	3.10	7.54
186	72	21.05	33	9.64	11.41	2.71	4.21
187	105	30.70	61	17.83	12.87	3.23	3.98
188	54	15.78	44	12.86	2.92	2.67	1.09
189	11	3.21	11	3.21	0		
190	21	6.14	24	7.01	-87		
191	89	26.02	41	11.98	14.04	2.94	4.77
192	194	56.72	126	36.84	19.88	3.73	5.32
193	173	59.58	120	35.08	15.50	3.73	4.15
194	151	44.15	88	25.73	18.42	3.57	5.15
195	98	28.65	71	20.75	7.90	3.27	2.41
196	81	23.68	41	11.98	11.70	2.88	3.01
197	208	60.81	102	29.82	30.99	3.61	8.58
198	220	64.32	130	38.01	26.31	3.68	7.14
199	97	28.36	54	15.78	12.58	3.13	4.01
200	119	34.79	82	23.97	10.82	3.07	3.52