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Date: September 8, 1982
A COMPARISON OF ACHIEVEMENT OF STUDENTS IN INDUSTRIAL ARTS TAUGHT BY COMPUTER-ASSISTED INSTRUCTION TO THOSE TAUGHT BY LECTURE/DISCUSSION METHOD

by

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The purpose of the study was to investigate and compare educational achievements in selected industrial arts units between groups of students taught by the computer-assisted instruction (CAI) method and those taught by the traditional teaching (lecture/discussion) method. The specific objective for the study was to measure the difference in educational achievement between two groups of junior high students in the areas of lineal measurement and oxygen-acetylene welding resulting from the two teaching methods.

Tests were developed to compare the differences in achievement between two types of teaching methods; these tests were validated by a jury of experts comprised of four Industrial Arts metal shop instructors. The tests were also tested for reliability by a split-half test and the Spearman – Brown prophecy formula.

Conclusions indicate that even though there was a significant difference in oxygen-acetylene welding and not in lineal measurement; it may be due to the subject area. Recommendations suggest that other subject areas such as foundry, arc welding, sheetmetal, etc., be researched using these two methods of instruction.
Introduction

With the development of technology in our society, the need for technological advancement has been created in the areas of educational television, satellite communication, and self-paced media. Few of these, however, hold the potential for individualized instruction as does the computer. With present-day costs increasing, a time-sharing system has facilitated the use of computers for educational purposes, and computer-assisted instruction (CAI) is now a reality in several elementary as well as junior high schools. Castle Rock Junior High in Billings, Montana, has been fortunate in being the only junior high in the Billings School District #2 to receive (from the district) seven Radio Shack TRS-80 microcomputers. Furthermore, this school is fortunate to have on staff a computer-knowledgeable person who is utilizing this equipment to coordinate all programs in Castle Rock's curriculum.

In this age of growing computer technology there have been few studies done on computer usage within the
industrial arts field; therefore, the author chose to test the achievement between groups of students taught by the traditional teaching method and those taught by the CAI method. The study encompassed two areas—lineal measurement, and oxygen-acetylene welding.

**Statement of the Problem**

The purpose of the study was to investigate and compare educational achievement in selected industrial arts units between groups of students taught by the computer-assisted instruction (CAI) method and those taught by the traditional teaching method.

**Objectives**

The objective of the study was:

1. To measure the educational achievements between two groups of junior high students in the areas of lineal measurement and oxygen-acetylene welding through two different teaching methods.

**Definitions**

The definitions used in this paper were found by the researcher in the Webster Dictionary; College Edition, 1966 - Education Research by L. R. Gay - and Creative Computing Magazine, 1982:

**Computer-assisted instruction (CAI)**--the use of a
microcomputer as an instructional teaching aid for drill practices—supported by the lecture/discussion teaching method.

Lecture/discussion instruction (Traditional Teaching Method)—a speech providing information and examination of a given subject area. This instruction method is also known as the traditional teaching method.

Lineal measurement—the measurement of a length or distance (the ordinary English ruler).

Micro-computer—a small integrated circuit which can perform the functions of a large computer (example—electronic calculator).

Oxygen-acetylene welding (better known as gas welding)—use of oxygen and acetylene gases for welding.

Hawthorne Effect—describes any situation in which subjects' behavior is affected not by the treatment, but by their knowledge of participation on a study.

Limitations
The limitations foreseen in this study were:

1. Students have been scheduled into the classes without regard to matched samples.
2. Only two teaching methods were used (CAI and lecture/discussion).
3. The Hawthorne Effect may affect the students
using the CAI method.

**Delimitations**

The delimitation of the study was:

1. Only four classes at Castle Rock Junior High were included in the study.

**Assumptions**

The assumptions made by the researcher in this study were:

1. That all students have used the computer.
2. By random selection from the metal shop student population, students within controlled and experimental group should be equal.

**Hypothesis**

In the hypothesis the researcher predicts a significantly higher score on corresponding achievement tests using the CAI method of instruction as compared to the traditional method. The acceptable level on the t-tests were established at the .05 level.

\[ H_1: \bar{x}_{CAI} > \bar{x}_{trad}. \]

1. Students utilizing practice drill in lineal measurement by the CAI method will achieve scores significantly higher (.05 level) on corresponding achievement tests than those assigned the traditional teaching methods.
H2: $\overline{X}_{\text{CAI}} > \overline{X}_{\text{trad}}$.

2. Students utilizing practice drill in oxygen-acetylene welding by the CAI method will achieve scores significantly higher (.05 level) on corresponding (unstandardized) achievement tests than those assigned the traditional teaching methods.
Chapter 2

Review of Literature

In this advancing world of technology man has never lived in such a rapidly changing society. Even more disturbing is that a study of history and predictions of the future tell us that our technology will advance at an ever-increasing rate. Such a rate will stagger even the well-trained mind, not to mention those of our society who know little or nothing about the technological world in which they live (Brook, 1979, p.208).

The degree of impact of technological advances on the society is best illustrated by the introduction of the hand-held electronic calculator into the market place. This tiny wonder replaced the slide rule and the electro-mechanical calculator and left manufacturers stunned. These small electronic packages are an indication of how modern electronics will continue to influence and drastically alter the future. Out of this technology came the micro-computer, which could easily perform the functions normally executed by the type of computer that would fill large rooms and require tons of climate control equipment.
to insure proper operation.

Prior to 1965 few educators used computers in their educational efforts because of three limiting factors: lack of knowledge about computers, excessive cost, and batch job processing (Rigby, 1979, p. 216). These factors have retarded the acceptance of the computers in education. Technological advancements and restructuring of society's acceptance of computer systems has created a definite advantage for the computer in our educational environment.

The wide acceptance of the computer by the non-academic segment of society has caused many educators to reevaluate the earlier excuses for not using computers such as cost, lack of background, and system organization. Analysis of these factors today will indicate all three are no longer applicable. Costs have fallen from $10,000-$15,000 to under $1,000 for a complete, independent, interactive system (Rigby, 1979, p. 216). The knowledge of the teacher is still a consideration, but due to the simplicity of today's programming languages, this factor is disappearing.

Computer technology and its related instructional capabilities have the ability to:

1. Provide interactive instruction where learners become active participants in the learning process instead of mere receivers of information.
2. Provide alternative learning paths within lessons or within courses to aid in student learning.

3. Offer independent pacing for individuals so that they may progress through courses at a rate that is suited to their learning style.

4. Give learners controlled reinforcement.

5. Evaluate student performance quickly and accurately to provide data on the degree to which learners have mastered predetermined objectives, and to aid in providing information that will help improve the effectiveness and efficiency of the course.


These capabilities have been applied to educational functions in a variety of ways. Computer-assisted instruction (CAI), computer-managed instruction (CMI), and computer-aided instruction all describe specific uses of the computer in education.

There has been a great deal of controversy surrounding the CAI method and its effectiveness compared to the traditional lecture/discussion method. In eleven studies comparing college student achievements in CAI and lecture/discussion learning environments, only three clearly showed student achievement to be superior in the CAI environment, while eight reported either mixed results or no significant differences (Pohl & Tsai, 1980, p. 120).

It was found that CAI-taught students learn a given unit of material in substantially less time than the time required for the same level of mastery by students taught in
Evidence has shown that CAI-taught students may learn faster but it is also noted that the same student may not retain as much as those students taught in the traditional way (McCulloch, p.13). Student performance in CAI has not as yet provided for consideration of stimulation and motivation of students with planned teacher/student contact. If students taught by CAI could be supplemented with teacher stimulation and motivation, McCulloch inferred that it is possible for a student to outperform his counterparts who were taught by the traditional teaching method (p. 13).

Many courses use the drill and practice method to help students remember material. This method can also be applied to the computer with some distinct benefits. First, the questions asked can be controlled on the basis of the student’s progress, therefore individualizing the learning experience. Second, the use of the computer accurately defines a sequence of instruction that students can manage and provides immediate feedback on their responses. Third, the learner has control over the pace of the learning (Caldwell, 1980, p. 142).

Some believe micro-computers have a potential to enhance the productivity of the individual teacher and
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improve the quality of the learning process. However, it is also felt that CAI is merely an automated, programmed instruction, rather than an intellectual enrichment.

Unless the curriculum is designed to teach something other than a collection of facts and unless the assessment measures more than a statistical description of what has been retained about these facts, learning will be all too rudimentary. Education must have a system which offers an extensive array of learning concepts not possible through strictly traditional teaching methods and materials (DeLaurentiis, 1980, p. 10). Students should be introduced to a variety of academic subject areas and concepts, but in a way that will capture their interest and enable them to readily find applications for these concepts (Holzman & Glaser, 1977, p. 5).

Students using the computer enjoy programs that cause a large amount of overt activity and permit a great deal of user-computer interaction. Because of this computer interaction, the military as well as vocational and technical training programs are attempting to use CAI to improve or expedite their training processes (Holzman & Glaser, 1977, p. 6).

It is difficult to make judgements about the role of CAI in teaching because there is actually no significant
teaching technology which deals with the design and evaluation of instruction based on meaningful learning (Dyer, 1976, p. 60). Despite efforts to develop CAI systems, as evidenced by the many diverse approaches to this goal, there remains considerable skepticism by many educators concerning the future role of the computer in education.

The one bright light at the end of this educational tunnel is that, in other studies, observations were made of the teachers and students, and comments made by them indicated that the children totally enjoyed their encounters with the computer (Holzman & Glaser, 1977, p. 6).

In conclusion, it is not known whether or not the powerful micro-computer will be the next technological advancement that will revolutionize everything from operating our homes, cars, offices, and laboratories to teaching our students. The computer will not replace the classroom teacher, but rather will become a powerful tool for the enhancement of the instructional programs.
Chapter 3

Methods

With the help of the staff at Castle Rock Junior High School in Billings, Montana, this researcher attempted to determine the difference in the achievements between two groups of students through the teaching methods they received. The two groups of students were enrolled in the Industrial Arts 8th grade metal shop program at Castle Rock.

Population Selection

Each student's period selection was randomly determined by the roll of die. The students enrolled in periods one and four were assigned to the traditional teaching method on lineal measurement and the CAI instruction method in the area of oxygen-acetylene welding. Those students enrolled in periods two and six were assigned to the CAI method in the area of lineal measurement and the traditional teaching method in the oxygen-acetylene welding area.

The design of the study was "The Posttest Only Control Group Device". According to Campbell and Stanly the posttest only design can be expanded to include more than
two groups or subject areas.

**Test Development**

The information gathered and used by the researcher in the development of the tests and worksheets originated from classroom materials. One source of information was the classroom text, and the other was handout materials. The text provided about half of the test questions and the handout materials the other half. Many questions could be used directly from the text, while others had to be rewritten to fit the format the researcher used in the design of the tests and worksheets. The developed tests and worksheets were used in the areas of lineal measurement and oxygen-acetylene welding.

**Validity**

The teacher-developed achievement tests in the areas of lineal measurement and oxygen-acetylene welding were tested for item and content validity by the jury method. This jury was composed of junior high school metal shop instructors within the Billings School District 2. The members and their school were: Jim Perusich - Will James, Jim Lechie - Lincoln, Wilbur Straw - Lewis & Clark, Dave Sieler - Riverside.

Each jury member was sent a letter explaining the problem (appendix A). After assimilating their input some of
the questions were changed and new tests were produced.
The tests used in the study can be seen in appendix-B for
the lineal measurement, and appendix-C for the
oxygen-acetylene welding.

**Instruction**

The instructional method for lineal measurement
consisted of a discussion of the English ruler and covered
the ruler layout in fractional forms of an inch such as:
1/2—1/4—1/8—1/16. The drill practice worksheets for the
traditional method were handed out in class while the CAI
worksheets were placed on a software program (appendix D).
This discussion was completed before the worksheets were
attempted either by the CAI group or the traditional
teaching groups.

The CAI practice drill worked in the following manner.
The program printed on the screen a randomly selected line
segment question or a measurement question. There was a
total of 40 questions on the computer for the CAI group;
those same questions were printed out on worksheets for the
traditional method group. The line segment question asked
how long the line was, with the answer given in measurement
form. If the CAI student answered the question correctly,
the computer registered a grade percentage in the upper
right hand corner of the screen. If the answer given was
incorrect the percentage decreased, but he or she had another chance to select the correct answer. Each question could be answered incorrectly three times but on the fourth the correct answer was given by the computer. The grade percentage increased or decreased depending on the answer given and the number of attempts made by the students. The second section of questions were asked differently. In this section the measurements were given, and the student were instructed to indicate the proper line length segment. All the computer functions were the same for both types of questions.

In comparison, the practice drill for the traditional teaching method group was to physically lay out the line segment asked for on the worksheet. These worksheets were corrected by the instructor and returned to the students the following day.

In the oxygen-acetylene welding, a discussion covering equipment, procedures, and handout materials was given to both groups. These worksheets were handed out in the same order as the measurement worksheets.

The oxygen-acetylene welding questions were slightly dissimilar. Although all the functions of the computer stayed the same, the questions were displayed differently. The questions were randomly selected and arrayed in multiple
choice form. There were 20 questions on the computer for the CAI group, and the same questions were placed on a worksheet and given to the traditional group. When the computer questions appeared the CAI student could key in his or her answer; if it was correct, the computer would continue to the next question. On the other hand, if the answer was incorrect (unlike with the measurement question), it would tell the student on what page in the book he or she should look to find the correct answer. After having checked the book, they could continue. However some students may have selected to bypass the book and by chance happen to answer correctly the question on the next attempt. The disadvantage of guessing at the correct answer and getting it incorrect was a percentage decrease which required the student to repeat the entire worksheet. The students were required to obtain a 100 percent on all worksheet questions before they were allowed to proceed to the hands-on portion of welding.

To check if the students did obtain the 100 percent, each student was assigned a computer. He or she would run the program, if all the questions were correct the 100 percent would register in the top right hand corner. If it was not there, the student would have to return to the beginning and start over.
The students in the traditional teaching groups were given the opportunity to study together. They were asked questions by the other groups members and were also required to achieve a 100 percent on all questions.

There were a few questions on the final test (appendix-C) which were covered in class by the Traditional Teaching method. Because of a break down of the computer, these questions were unable to be placed on the computer at the time of the study.

Administering the test

To reduce the possibility of bias in the study, the researcher assigned another person to administer the tests. He was given verbal instructions on how the test was to be given, and told not to indicate to the students that it was an experimental study. This individual not only administered the test; he also collected, corrected, recorded, and handed back all the tests. When all of these items were completed, the researcher began to analyse the data for reliability.

Reliability

The split-half test and Spearman-Brown prophecy formula were used to determine reliability on the test. The split-half test was accomplished by giving the total test to a group and then dividing the test into comparable halves,
odd numbered questions and even numbered questions.

The two halves were scored separately and a Pearson correlation coefficient between the two scores was calculated. Since longer tests tend to be more reliable, and since the split-half reliability represents the reliability of only half the actual test, the Spearman—Brown prophecy formula was applied to estimate the reliability of the total test.

The Spearman—Brown prophecy formula is a correction formula which must be applied to the coefficient of a test. For example, suppose the split-half reliability coefficient for a 50 question test was .80. The .80 would be based on the correlation between scores on 25 even questions and 25 odd questions. Therefore, the estimated reliability would be for 25 questions and not all 50 questions. By using the split-half estimate of .80 from the previous example, it was corrected to .89. The Spearman—Brown prophecy formula is:

\[ r_{\text{total test}} = \frac{2r_{\text{split half}}}{1 + r_{\text{split half}}} \]

In the test given to the group on lineal measurement, the split-half reliability test was used for internal consistency and resulted in a correlational coefficient of .909896. By the use of the Spearman—Brown prophecy formula, the correlational coefficient was corrected to
In the test given to the group on oxygen-acetylene welding, the split-half reliability test was used for internal consistency and resulted in a correlational coefficient of .650247. By the use of the Spearman - Brown prophecy formula, the correlational coefficient was corrected to .78806.

Summary

To achieve the objective of this study, tests were developed to compare achievement between two types of teaching methods. The validity of the tests was accomplished by the jury method. Instructions were given to each population about the worksheets and tests prior to their use. When the time came for administering the test, an outside individual was chosen. This person also corrected and recorded all the scores. A split-half test and the Spearman - Brown prophecy formula were used to test for reliability. The data resulting from the students' tests will be discussed in the next chapter.
Chapter 4

Presentation and Analysis of Data

This chapter presents the data which determines: Mean, Median, Standard Deviation and t-test. All of the data are relationships between two groups of students -- one group taught in the traditional instruction method and the other group taught by the computer-assisted instruction method. In comparing the CAI method versus the traditional teaching method using the t-test, a .05 level of significants was used for the lineal measurement and oxygen-acetylene welding t-scores. The t-scores were influenced by the standard deviation, and the degrees of freedom left when the restrictions were imposed on the data.

Hypothesis one was that students utilizing practice CAI method would achieve scores significantly higher on corresponding achievement tests than those using the traditional teaching method. The sample for this hypothesis was 39 for the computer-assisted method, while the traditional method was 41. The data in Table 1 indicate the differences in achievement for lineal measurement between
the computer-assisted instruction group and the traditional instruction group.

Table 1 — Comparison of Posttest scores on Lineal Measurement Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Size</th>
<th>Means</th>
<th>SD</th>
<th>Median</th>
<th>Pooled Variance estimated of <em>t</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAI</td>
<td>39</td>
<td>28.538</td>
<td>12.3754</td>
<td>35</td>
<td>1.85</td>
</tr>
<tr>
<td>Trad.</td>
<td>41</td>
<td>32.8293</td>
<td>8.07435</td>
<td>35</td>
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</table>

Data arrayed in Table 1 reveal that the CAI method resulted in a mean of 28.54 and standard deviation of 12.37. The traditional instruction method resulted in a mean of 32.83 with a standard deviation of 8.07. When comparing the data utilizing the _t_-test, a _t_-score of 1.85 was obtained. This _t_-score was not significant at the .05 level; therefore, the hypothesis was rejected.

Hypothesis two was that students utilizing practice drill in oxygen-acetylene welding by the CAI method would achieve scores significantly higher on corresponding achievement test than those using the traditional teaching method. The sample for this test was 41 for the computer-assisted method, while the traditional method was 40. The data in Table 2 indicate the differences in
achievement for oxygen-acetylene welding between computer-assisted instruction group and the traditional instruction group.

Table 2 — Comparison of Posttest scores on Oxygen-Acetylene Welding

<table>
<thead>
<tr>
<th>Groups</th>
<th>Size</th>
<th>Means</th>
<th>SD</th>
<th>Median</th>
<th>Pooled Variance estimated of t</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAI</td>
<td>41</td>
<td>26.9512</td>
<td>4.53845</td>
<td>28</td>
<td>2.24*</td>
</tr>
<tr>
<td>Trad.</td>
<td>40</td>
<td>23.875</td>
<td>7.19041</td>
<td>25.5</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05

Data arrayed in Table 2 reveal that the CAI method resulted in a mean of 26.95 and the standard deviation of 4.54. The traditional instruction method resulted in a mean of 23.87 with a standard deviation of 7.19. When comparing the data utilizing the t-test, a t-score of 2.24 was obtained. This t-score was significant at the .05 level; therefore, the hypothesis was accepted.

Conclusions

Based on the data collected in the study, it was concluded that there may or may not be an advantage in the use of a micro-computer for practice drills as an instructional aid. The researcher concluded that in the
area of oxygen-acetylene welding, students using the computer-assisted instruction method covered the required materials in a shorter period of time with a greater degree of accuracy on the final test.

The traditional teaching method used for oxygen-acetylene welding required more student time to cover the material with lower scores being achieved on the final test.

Even though there was a significant difference in one area and not the other, this may be due to the subject area. These differences may have occurred in the measurement area due to the fact that physically laying out the lines was better for the students than to just punch in the lines on the computer.

A challenge came to mind, if a student had more time on the computer in a certain instructional area and the programs base was very large could that student learn more in the same amount time frame as was used in the study? The study also does not answer what could be the results of better programs, more questions in each program, or the design of the questions. It does indicate that the computer along with the teacher as support can be an educational advantage for the students.
Recommendations

Upon the completion of this study certain recommendations were reached. It is recommended by the researcher that if a person is going to attempt to do any classroom work on the computer, he or she plan to give a student a sufficient amount of time to use the computer. This could be in any type of program and repeated until the student feels at ease with the computer.

When looking at the multitudes of software programs, pick the best ones for your area. If you’re not sure if a program is good, consult a person who is familiar with programs. There are many programs which look good on the surface but are not worth the cost. In many ways it may be better for an individual to develop his or her own programs. In this way they would be able to produce exactly what is needed in their subject area. Two problems arise when writing one’s own programs. The first is the design of the questions. In most cases only true or false, or multiple choice questions can be used, therefore, the instructor must be selective in the questions he or she chooses. There should be enough questions in the program so the computer has a large random selection; in this way the same question does not appear too often on the screen.

It is further recommended that no matter what type of a
group you work with, arrange them so you have total control over what they do. For example, when you have three students working together, one may be doing the work for the others. It could also happen that students will stick up for the others (saying they had completed the required work when in fact they had not).

This researcher would recommend an additional study. This study should include changing to a different subject area within the industrial arts field, and also changing the format in which the questions on the worksheets and tests were given. By changing subject areas, one may achieve a totally different set of results on the final tests.

Summary

The computer came into existence along with the development of technology in our society and the greater need for speed and accuracy. From these large cumbersome machines came the micro-computer. Since the micro-computer came on the market it has taken over many jobs of the large machines in industry. One of these industries is education where the computer is increasing as a powerful tool. Many programs are being produced on software to be purchased by an instructor, but programs can also be made up by that instructor to fit a special need.

This area of special needs is the reason this study was
done. There has been very little done with the computer-assisted instruction in the industrial arts field. This study used the CAI method of instruction, and compared it with the traditional teaching method (lecture/discussion), to see if there were any advantages to using it. In the process of the study it was concluded that there are advantages and disadvantages to this type of instruction.
BIBLIOGRAPHY
Bibliography


APPENDIX A
Cover letter to Jury Members
I am conducting a research study to compare achievement in selected units within the industrial arts field. This study is between students taught by the computer-assisted instruction (CAI) method, and those taught by the traditional teaching (lecture-discussion) method.

Two of the objectives are to: 1) measure the achievement between two groups of students in the areas of lineal measurement and oxygen-acetylene welding through the two different teaching methods; and 2) measure the retention of the materials in those two areas.

Your evaluation would assist me in determining changes that may need to be made prior to its actual use in the research study.

In evaluating the instrument, please:

1.) Read each test question for clarity, relevance, and importance to this area.

2.) At the end of each test, list any additional comments that you believe would help in making this instrument more relevant or increase the clarity.

Your cooperation in furnishing the requested information would really be appreciated. A self-addressed,
stamped envelope is enclosed for returning the completed instrument with your suggestions.

Please mail it back by November 30, 1982.

Thank you for your time, effort and interest.

Sincerely,

Darrell F. Benner
Researchers
APPENDIX B

Lineal Measurement Final Test
MEASUREMENT TEST - 1

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APPENDIX C
Oxygen-Acetylene Welding Final Test
OXYGEN-ACETYLENE WELDING TEST

1. Oxy-acetylene welding is commonly known as?

2. Name the basic equipment used in the gas welding process (6 answers).

3. Heat alone is used in _______ welding?

4. The flame used in gas welding burns at a temperature of _____°F?

5. What tool is used to light a torch?

6. In gas welding, _____ and _____ are burned in the welding torch.

7. Acetylene is a very explosive gas? T or F

8. The materials used to build up a weld in gas welding are made of _____ with a _____ coating.

9. Before attaching a regulator, oil the treads lightly. (T or F)

10. Name the device used to reduce the cylinder pressure to a constant working pressure.

11. The acetylene hose is what color?

12. Welding tips can be cleaned with a standard _____.

13. Acetylene becomes very unstable beyond the pressure of _____ #/sq.in.

14. A neutral flame has equal amounts of oxygen and acetylene. (T or F)

15. What is used to test for leaks in gas welding equipment?

16. When gas or oil comes in contact with _____ under pressure, it may burst into flames.

17. The right-hand gage of a regulator tells the pressure in the ______.
18. When selecting the diameter of welding rod and tip to use, the thickness of the metal to be welded is the main consideration. (T or F)

19. The oxygen hose is what color?

20. The brass fitting with the groove in it means the threads are ______ handed.

21. The left-hand gage on the regulator tells the pressure.

22. The scale on the oxygen cylinder pressure gage reads from 0 to ______#/sq.in.

23. Why are the two cylinders always chained?

24. How do you know what gas you are using?

25. Name the three types of joints. (3 answers)

26. Name the three types of flames. (3 answers)

27. The scale on the acetylene regulator which tells the pressure at the torch goes from 0 to ______#/sq.in.

28. The holes on the end of the tips range in size as follows: the small the number the larger the hole.

29. The welding torch should be ignited with: (one answer) another torch, a friction lighter, a match, or hot metal?
APPENDIX D
Lineal Measurement Worksheet
Sample worksheet which was used on the computer

HOW LONG IS THE SEGMENT BELOW?

HOW LONG IS IT?

HOW LONG IS THE SEGMENT BELOW?

HOW LONG IS IT?

DRAW A SEGMENT 3/16 INCHES LONG.

DRAW A SEGMENT 2 AND 3/16 INCHES LONG.
APPENDIX E
Oxygen-Acetylene Welding Worksheets
1.) All welding is the process of joining metals by the use of:
   1. Heat alone
   2. Pressure alone
   3. Heat and/or pressure
   4. None of the above

2.) Welding _____ work with engineers in experimental work.
   1. Experts
   2. Technicians
   3. Operators
   4. None of the above

3.) When only heat is used in welding, the process is called _____-type welding.
   1. Flame
   2. Fusion
   3. Arc
   4. Resistance

4.) Heat and pressure are used in _____ welding.
   1. Gas
   2. Friction
   3. Resistance
   4. Brazing

5.) Oxygen cutting, or _____ cutting, is closely related to welding.
   1. Seam
   2. Friction
   3. Laser
   4. Flame
6.) There are over _______ welders and oxygen cutters.
   1. 98,000
   2. 5,000
   3. 100,000
   4. 480,000

7.) Which is not one of the common types of welding:
   1. Gas
   2. Resistance
   3. Spot
   4. Arc

8.) The hot flame in gas welding burns at a temperature of about:
   1. 3,000°F
   2. 5,200°F
   3. 6,300°F
   4. 7,500°F

9.) In gas welding, ______ and ______ are burned in the welding torch.
   1. Oxygen & Argon
   2. Argon & Inert gas
   3. Acetylene & Oxygen
   4. Inert gas & Acetylene

10.) The material used to build up a weld in gas welding is called a _______.
    1. Brazing welding rod
    2. Electrode welding rod
    3. Mild-steel welding rod
    4. High-speed steel welding rod

11.) The oldest pressure-welding process is welding.
    1. Forge
    2. Arc
    3. Gas
    4. Resistance
12.) A method of cutting metal with the hot flame from the gas torch is called _______.
   1. Flame cutting
   2. Acetylene cutting
   3. Gas cutting
   4. Weld cutting

13.) Before attaching a regulator, oil the threads lightly.
   1. T
   2. F

14.) A filler rod for 18-gage sheet steel should be about?
   1. 1/8 inch
   2. 1/16 inch
   3. 3/16 inch
   4. 1/4 inch

15.) When gas or oil comes in contact with ______ under pressure, it may burst into flames.
   1. Acetylene
   2. Oxygen
   3. Spark lighter
   4. A match

16.) The welding torch should be lighted with:
   1. Another torch
   2. A friction lighter
   3. A match
   4. Hot metal

17.) Acetylene hoses are what color?
   1. Red
   2. Green
   3. Black
   4. Yellow

18.) To test for leaks in welding equipment, a welder should:
1. Use oil
2. Use a match flame
3. Listen for escaping gas
4. Use soapsuds

19.) When selecting the diameter of welding rod for a job, the main thing to consider is:
   1. Size of the tip
   2. Thickness of the metal to be welded
   3. Amount of penetration
   4. Amount of pressure at the torch

20.) The metal filler for the welding in arc welding is supplied by a_______.
   1. Mild steel rod
   2. Electrod
   3. Brazing rod
   4. Tungsten
APPENDIX F
Key to Measurement Final Test
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APPENDIX G
Key to Welding Final Test
Key for Oxygen-Acetylene Welding Test

1. Gas Welding

2. 
   A. Oxygen cylinder
   B. Acetylene cylinder
   C. Two regulators
   D. Two lengths of hose
   E. Welding torch & tips
   F. Goggles

3. Fusion

4. 6300°F

5. Friction Lighter

6. 
   A. Oxygen
   B. Acetylene

7. True

8. 
   A. Mild steel
   B. Copper

9. False

10. Regulator

11. Red

12. Tip cleaners

13. 15 lbs.

14. True

15. Soapsuds

16. Oxygen

17. Cylinder

18. True

19. Green
20. Left
21. Working pressure
22. 4000#/sq.in.
23. Protect them from falling
24. By the label on the tank
25. A. Butt  
   B. Lap  
   C. Tee
26. A. Oxidizing  
   B. Carbonizing  
   C. Neutral
27. 30#/sq.in.
28. False
29. A friction lighter