VISUAL INSTRUCTION SUPPLEMENTARY
TO INDUSTRIAL EDUCATION

by

PHIL A. HORNER

A THESIS
submitted to the
OREGON STATE AGRICULTURAL COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

July 1937
ACKNOWLEDGEMENT

I wish to acknowledge the very helpful advice and assistance given me in the preparation of this thesis, especially by Professor George B. Cox, whose assistance has been freely given during the graduate study, and by Professor George Eby, whose criticisms have been very helpful.

To the many who answered the questionnaire sent them, and to those who answered questions asked them during personal interviews, I wish also to express my appreciation.

P. A. H.
TABLE OF CONTENTS

I Introduction.................................................. Page 1
   a. Reasons why visual material has not been used more extensively

II The Problem.................................................. 13
   a. Purpose of the study
   b. Procedure in making the study
   c. Centralization tendency in visual material
   d. The use of the questionnaire
   e. Copy of the questionnaire and letter of transmittal

III Summary of the Study................................. 22
   a. The results of the questionnaire as indicated by the answers received
   b. An experiment involving visual aids and the high school shop student

IV Conclusions and Recommendations............... 49

V Bibliography.................................................. 53

Appendix

A. Suggested methods of presenting the following visual aids in connection with class work
   1. The motion picture
      a. Presenting the film to the class
   2. Stereoptican slides
      a. Steps to avoid when using slide sets
      b. Points for evaluating any given slide
   3. Graphs
   4. Field trips
   5. Educational exhibits
   6. Flat type pictures

B. Score sheets
VISUAL INSTRUCTION SUPPLEMENTARY
TO INDUSTRIAL EDUCATION

FOREWORD

This study is the result of an effort to present in usable form information and ideas concerning a practical program of visual instruction correlative with the present industrial education program. It is believed the plan employed is capable of returning fruitful results from (1) the viewpoint of efficiency in student learning, (2) improved methods of instruction, and (3) saving in teacher time.

The study is presented with the hope that it may possibly help others to incorporate visual aids into an already functioning shop program. It seems the more significant after personal contacts with teachers of the industrial arts subjects. Many teachers are aware of the results obtainable from visual instruction methods but are not sufficiently trained in the handling of such methods and materials to produce results outstanding enough to justify the added expense. There has been to date so limited an amount of training available in the field of visual instruction that such a situation is rather to be expected. Visual materials cannot be
successfully utilized by the average teacher without careful study and some training in an efficient technique. Otherwise the program is most likely to over-emphasize the visual materials without sufficient student preparation and follow up, or to employ so little visual material that the full value of a more complete program is impossible.
I. INTRODUCTION

VISUAL INSTRUCTION IN THE FIELD OF INDUSTRIAL EDUCATION

In undertaking a study of this type it is well first to formulate a definition of visual instruction so there will be a common ground upon which to proceed. Speaking from an all inclusive standpoint, visual instruction is not a separate subject. However, one phase of it that is new, and one upon which we can expect improvement, is the added means of bringing to the student through pictures a vivid story of all sections of the world. We should feel fortunate in this respect and not fail to take advantage of some of the many opportunities now offered.

The laws governing the principles of observation, which are the basic factors of visual instruction, have in no way been altered, but the further development of pictorial representation has strengthened the whole process of visual instruction. Any use of visual aids that fails to recognize the necessity for voluntary attention and natural mental reaction will fail miserably in worth while educational results. It would be an unfortunate situation should the introduction of visual instruction become an end in itself and thus add one more burden to the already
over-crowded educational program. Instead, it should be considered an educational tool and should be used solely as a means to an end. Throughout this thesis the term "visual instruction" will be referred to in its broadest sense, as the enrichment of the educational processes through "seeing experience." It will be centered around all of the usable visual aids. Examples of usable visual aids are: working-models, field trips, graphs, charts, diagrams, educational exhibits, glass slides, still-films or film strips, moving pictures, and all other means found usable and useful in promoting more efficient mental imagery, visualization, and understanding of instruction in any subject whatever.

It should be emphasized that the concern is not with any one of these educational tools as such, and with each of them only to the extent that they may help teachers solve the usual classroom problems. It would seem possible that this medium is one of the surest and best for stimulating a student's interest toward procuring new information that will help him to become a better citizen and enable him to lead a more useful and a happier life.

Conditions of living are increasing in complexity and one of the chief aims of the shop program is to enrich student experiences in the industrial occupations and increase the knowledge of materials, processes and problems of industry. Obviously, this can be accomplished only by giving
students a much fuller understanding and a better appreciation of the industrial environment in which they exist. The modern slogan is efficiency in work with economy of time. Industries, business leaders, in fact all successful enterprises are judged on these criteria. These two factors then are as necessary and important in education as elsewhere, but there seems to be a lagging behind. This condition is true because of the process of breaking away from the old complex of formal education and advancing into a new, experimental period. Also it is the natural and necessary reaction caused by the rapid strides industry is making and the attempt to keep the educational systems functioning.

One thing noticeable is the widening of possibilities brought about by industrial changes and with them the demands for progressive educational leaders whose job it will be to seek out new and better ways of enriching the teaching procedure. This new era need not depend wholly upon theories and ideas for these advances. The present educational system is fairly well founded upon psychological principles that should be able to withstand progressive theories. Society has experienced such fads in the past years but only those that are built on sound pedagogy have weathered the strain.

Only recently has there been a tendency toward far-flung experimenting with visual instruction and time alone will show the way of progress. The aim of every progressive
teacher should be to plan and to present his work so that the students may master the subject (technique or information) with facility and with economy of time. Among the methods to be employed should be listed everything that increases the appeal and clarifies the subject-matter, for such methods will promote efficiency and give more time for other endeavors.

It is with an anticipation of the far-reaching effects a rightly sponsored and conducted program in visual instruction can have in the teaching of shop subjects that this study is presented. At present the information dealing with visual instruction satisfactory for various phases of industrial education is widely scattered. One desiring to lay out a satisfactory program that will interlock with the daily teaching program is dependent upon magazine articles and pamphlets issued by various universities, industrial concerns and governmental departments.

The instructor who has experimented with visual aids in his shop program has no doubt concluded that this is one of the easiest and surest methods of promoting natural learning. In visual instruction he probably has found some of the most efficient instruments wherewith to insure vividness and concreteness of concepts formed by the students. If so, the uppermost thought of every sincere shop instructor should be to organize his course to embrace these aids and thereby increase the efficiency of instruction.
In many schools the equipment for a visual program is available but the efficient use of that equipment involves problems which have not confronted teachers before. Unless thought and intelligent study is given to this problem, much money and time are likely to be wasted. For example, a film may come to the school from the realm of entertainment, with instruction only incidental. Others, unless carefully selected or edited, may be largely advertising. Unless care is exercised, the teacher will be using these visual devices to supplant rather than to supplement other forms of instruction.

It can be shown that properly selected visual material is beneficial and that, properly used, it promotes good instruction. But the question is raised, "if that be true, why has not more of this work been done up to the present?" Careful study and consideration make it possible to attribute at least six specific reasons that may in a measure explain this situation.

1. Lack of teacher-training in the use of visual material.

2. Failure on the part of teachers to realize the value of visual material as a teaching aid.

3. Lack of adequate facilities for showing films and slides.

4. Inadequate knowledge of available sources of visual material and poorly organized lists of materials.

5. Course of instruction planned without correlation of visual aids.

These will be treated separately in the following paragraphs.
Lack of teacher-training in the use of visual material. 

The primary cause of failure to use visual aids can be attributed to the attitude of the teacher. This is actually the key to the situation. No visual material can serve its maximum purpose unless it is sponsored by the intelligent cooperation of a leader. A school system may have an abundance of visual aids, the greater part of which is ineffective in a class with an untrained teacher. It is paramount, therefore, that a part of the training of teachers be in the intelligent use and logical adaptation of visual materials suited to specific units of instruction. Teachers should know the visual aids best fitted to enrich the program, and also the opportune time for presentation.

At present some eighty-two courses in visual instruction are offered by the universities, colleges and normal schools. (6)* These courses vary in wide limits but few of them offer demonstration lessons in the use of the different types of visual aids. No course should be considered basic for teachers that does not spend approximately a third of the time in actual demonstration. Perhaps not much progress can be expected until the teacher-training institutions require the graduating prospective teachers to have a knowledge of: (a) the simple visual aids,  

*Numbers in parenthesis refer to numbered items in bibliography, page 53.
(b) the necessary apparatus, (c) some practice in their use in actual classroom situations. The teachers should be able to make a distinction between the simple worthwhile visual materials available and those novelties that are expensive and educationally inefficient. It is one of the aims of this study to present the fundamentals of such a course.

Failure on the part of teachers to realize the value of visual instruction as a teaching aid.

Attention may not have been called to the importance of visual instruction in connection with teaching and for this reason interest has not been sufficiently aroused to cause intensive investigation of the possibilities. All are aware that visual material exists but that too often represents the extent of thought relative to the topic.

Lack of adequate facilities for showing films and slides.

The motion picture and the stereoptican slide are the divisions of visual instruction that unconsciously come to the minds of most teachers when the subject of equipment is spoken of. This is due either to skillful advertising on the part of the manufacturers of this equipment or more probably to a limited understanding of how extensive and broad is the field of visual instruction. Many go no
further than to realize the hopelessness of the situation if equipment of that type is not at hand. Too little time is spent in devising ways and means of presenting these other visual materials that the students may enjoy and undoubtedly profit by.

**Inadequate knowledge of available sources of visual material and poorly organized lists of material.**

As has been mentioned before, in order to compile a list of sources from which satisfactory material may be secured it is necessary to go to magazine articles, government bulletins and numerous pamphlets issued by various industrial and educational establishments. This is an endless task and discourages even the most enthusiastic. Much of the material obtained does not fit into the program, all of which adds nothing to one's zeal to continue.

Practice in the larger cities is to compile lists of the available visual materials from which the teachers can make their selections. Upon examination of these compilations it is at once apparent why visual aids have not been accepted more rapidly in the industrial arts program. The motion picture films listed by some of the cities and state universities contain from 60% to 75% advertising films loaned by industrial concerns solely for the purpose of promoting their methods and merchandise. The educational value of such films is often questionable. They are probably
included in these lists mainly because they can be secured without cost.

The catalogs listing lantern slides also contain a large percentage of subjects unrelated to the industrial arts program. In a rapid survey of a number of these lists more than half made no effort to classify them into related groups. Others give no explanation or summary of the contents designed to show for what they were suited. The listing of visual aids in tabulated form is only a start in really making them adaptable to units of instruction. Industrial arts instructors hesitate to give time from their regular class work for visual material about which there is uncertainty of real educational value. Conversation and correspondence with instructors has demonstrated this to be a fact.

Thousands of dollars and the entire activity of a special group of people have been utilized within the past few years in an effort to make films which are suitable for various instruction purposes. There is now a rapidly increasing, though still woefully inadequate, library of splendid educational films and slides designed and produced strictly for their educational content. Most of them, however, still serve best as a supplement to the regular work. Too few educators are aware that the paramount level has not been reached and try to depend too heavily upon the material as it comes. There is little thought of using it
as reference material or as a tool to further their purposes.

**Course of instruction planned without visual aids as a help.**

As a consequence of the four previously qualified causes the instructors make no recognition of visual aids in intensifying class discussions when planning the class work and the supplementary related information. Because of unsatisfactory experiences with their first attempts instructors often feel there is little value in the visual aids available.

Next in importance to the attitude of the instructor towards visual aids comes the matter of the course of study. The tentative course of study determines:

(a) What the student shall do during school hours
(b) The topics to be studied
(c) The ideals to be acquired
(d) Attitude toward industry
(e) Testing program to be followed, etc.

all of which materially affect later life.

The present tendencies in educational procedure are the relating of school activities to life situations. Visual aids are filling an increasingly larger place in school activities as these new ideas are formulated.
II. THE PROBLEM

The purpose of this study was to determine how extensively visual material, as aids to the educative process, are being used throughout the school shops of the various states. Before the actual start of this problem there were several questions that needed answering pertinent to the subject. As the study proceeded the following questions were answered either wholly or partially:

1. Are teacher training institutions giving the prospective teacher the necessary instruction and practice in handling visual aids and apparatus pertinent to their use?

2. What are the sources from which usable visual material may be secured for school use?

3. What are the common prevailing practices in presentation of visual material?

4. What benefit is the furtherance of visual instruction having on student learning?

5. What percentage of the secondary school systems in the United States are making some recognized use of the available visual material?

Also as a part of this study methods of utilizing and presenting the various visual aids in school shop classes are discussed.

Procedure in Making the Study

The initial step in collecting the information was
a detailed survey of the literature dealing with visual aids. Since very little published material is available in this field it has been necessary to employ other methods. The questionnaire survey, personal experimentation and personal contact with many other teachers in this field have been instrumental in the furtherance of the study. The questionnaire broadened the scope from which the information was drawn but the most helpful material was gathered from personal interview and experimentation. These last two methods furnished not only concrete evidence but gave the added opportunity of evaluating teacher personality against the efficiency of results obtained from the visual instruction programs in use.

Centralization Tendency for Visual Aids

Visual instruction not being a new subject, teachers for the past many years have gathered collections of materials and devised individual methods of presentation suitable to their particular teaching situation. However, a movement is now gaining momentum towards the centralization of this sort of material and with it enlargement of the scope of visual aids.

State universities are commanding a leading role in this movement with their extension service, designed primarily to help the public school. This service did not at first offer any considerable amount of material relative
to the industrial arts field but the newer publications from representative university departments show the demand and supply are approaching a balance. Industrial organization, realizing the possibilities of educational programs relating to their various products have and will continue to gather into centralized localities a higher order of visual material, a good part of which is worthy of its showing time.

The development of new equipment better suited to schools is also a contributing factor in this recent trend towards centralization and enlargement. These factors show reasons why it seems more hopeful for increased use of visual material in the school shops.

The Use of the Questionnaire

To determine the frequency with which visual instruction was being carried on in the various secondary school shops, a questionnaire was prepared and sent to three hundred representative secondary school districts throughout the United States with an enrollment of one thousand pupils and more. One hundred thirty-five copies (45%) were returned. The larger percentage that came back were from eastern school systems but every state in the union is represented by the answers.

Various material was asked for relative to the work carried out; the principal phases covered were:
1. The types and sources of the various visual material being used in different sections of the country.

2. The types of visual equipment most commonly owned by the school system and the possibilities of borrowing or renting from local or university sources.

3. The manner in which the visual instruction is being put to use by various school plants.

4. The values that instructors attach to the visual aids in relation to their teaching programs.

A letter of transmittal was enclosed with each questionnaire. A copy of the transmittal and of the questionnaire follows.
November 14, 1933

Gentlemen:

The question frequently arises as to how extensively the visual education program is being carried on in connection with industrial arts and trade-training courses. It is our purpose to determine what forms of visual aids are being employed, the number of teachers making use of these aids, how they are used, and what educational value they may have in the industrial program. It is, also, our purpose to make the results of this study available to industrial arts and trade teachers, especially to those cooperating in this study.

Such a study has been undertaken, in cooperation with Oregon State College. You can assist materially in making this information available if you will take a few minutes to answer the enclosed questionnaire. It will require no writing. Merely underscore the proper words to complete the response. A self-addressed envelope is enclosed for your convenience, and there is an extra copy of the questionnaire for use in comparing your answers with the final results of the study when they are made available.

We will appreciate your cooperation in this study and hope to receive your response at an early date.

Very truly yours,

[Redacted]

Coordinator

Approved by
George B. Cox
Professor of Industrial Education
QUESTIONNAIRE ON TYPES, SOURCES AND USES
OF VISUAL TEACHING AIDS

TYPES AND SOURCES OF VISUAL AIDS USED

1. Do you make use of visual aids for instructional work in industrial arts?  
   Yes  No

2. Is your principal heartily in accord with a visual education program?  
   Yes  No

3. Which types of visual aids do you employ most?  
   glass or film-strip slides  
   motion picture films  
   (Place two lines under one most used; one under next)
   charts and diagrams  
   photographs and pictures  
   pictorial instruction sheets  
   manufacturer's exhibits  
   field trips
   (others)

4. Which type do you think has the most educational value in the industrial arts field?  

5. In which types of visual aids have you found the greatest amount of helpful material for industrial arts, up to the present time?  
   slides  
   films  
   (Place two lines under first choice; one line under second)
   charts  
   photographs  
   pictorial sheets  
   exhibits
   (others)

6. Do you have trouble in securing suitable films for class use; films that are pertinent to your class discussions?  
   Yes  No

7. Have you a suitable list of slides from which to order?  
   Yes  No

8. Have you a good list of films from which to order those that you want in connection with your classes?  
   Yes  No
9. Does your school system own any glass or film-strip slides suited to your work?  Yes  No

10. Does your school system own any films that are suitable for your classes?  Yes  No

11. Have you ever made slides pertinent to your own course of study?  Yes  No

12. Does your school willingly pay rental or carrying charges on visual material that you may want to use in the Industrial Arts Department?  Yes  No

13. Do you think the cost of visual aids (transportation and rental) is too great, compared with their educational value?  Yes  No

14. If you were given a choice which would you buy for your shop?

   (Underline one)  
   motion picture machine  
   glass slide projector  
   film slide projector

15. Are you able to secure sufficient good wall charts that cover equipment and material in your shop?  Yes  No

16. Do you take your students on field trips to industrial plants?  Yes  No

17. Do you consider the educational value of these trips worth the students' time?  Yes  No

18. Have you ever had your students either individually or in small groups construct a scale working model of a boat, train, industrial plant, house, mine or anything of that nature?  Yes  No

19. If so, do you think it has possibilities as an educational device in our present school-shop setup?  Yes  No

20. Do you display any of the educational exhibits that may be obtained from various industrial concerns?  Yes  No

   SURVEY OF EQUIPMENT AVAILABLE

21. Does your school have a 35 M.M. motion picture projector?  Yes  No
22. Does your school have a 16 M.M. motion picture projector? Yes No

23. Are these accessible for use in the Industrial Arts Department? Yes No

24. Does your school have a glass slide projector? Yes No

25. Does your school have a film slide projector? Yes No

26. Are these accessible for use in the Industrial Arts Department? Yes No

27. If your school does not own any or all of these items, can they be borrowed or rented from local sources, or from your State University? Yes No

(Mention yes or no, and underline ones available)

motion picture projector
film slide projector
glass slide projector

28. Do you have arrangements for showing films or slides to shop classes without the necessity of taking the classes to a special room not under your control, and consequently not always available? Yes No

MANNER OF USING VISUAL AIDS

29. Do you use films or slides to increase student appreciation of the field of industry? Yes No

30. Do you attempt to give your students any appreciation of what our industrial development has been, by the use of films, slides or pictures? Yes No

31. Have you used films or slides to give occupational or vocational information in the various industrial or manufacturing fields? Yes No

32. Do you use films or slides to supplement your class discussions and demonstrations? Yes No

33. Have you used films or slides to give direct instruction in shop subject matter, rather than as supplemental to your demonstrations and discussions? Yes No
34. Have you ever used slides for quiz or examination purposes?  
Yes  No

35. Do you hold your students accountable for the visual material that you show them?  
Yes  No

POSSIBLE VALUES OF VISUAL AIDS

36. In your estimation, does employing visual material speed up the learning process on the part of the student?  
Yes  No

37. Do you believe visual aids make possible a better use of the teacher's time?  
Yes  No

38. Do your students respond enthusiastically to visual material used in connection with class discussion?  
Yes  No

39. Do you get good attention from your students while showing pictures and while on field trips?  
Yes  No

40. Do you believe your students develop any better methods of observation from a visual program?  
Yes  No

41. Do you think your students remember what you show them in class longer than what you tell them in class?  
Yes  No

42. Do you feel that your visual program has helped in making your teaching methods better and more effective?  
Yes  No

Remarks:
SUMMARY OF THE STUDY

The results of this questionnaire having been drawn from all parts of the union, the following answers can be taken as fairly representative. The fact that the greater percentage of answers came from the eastern states does not necessarily indicate that more interest and attention is given this subject there. The population centers are larger and there were, from the percentage basis, more copies sent to that locality. The state of California was represented fairly well throughout and visual instruction is used in the majority of the systems.

By dividing the United States into three areas: western, central and eastern, it is possible to get a better idea of the geographic distribution from which the questionnaire answers were received.

- The eleven western states 20 - 14.3%
- The Mississippi valley states 36 - 27.4%
- The eastern states 79 - 58.3%

**Questionnaires returned unanswered**

There were also thirteen questionnaires returned unanswered but with a notation stating that no visual aids were used in the shops. The following reasons were given for this condition:
Iowa 3 returned—lack of funds to carry on the work
Maine 1 returned—no explanation
W. Virginia 1 returned—no explanation
Georgia 2 returned—not interested—lack of funds
Ohio 4 returned—work had been discontinued for lack of funds
California 2 returned—no explanation

**Those who supplied the information for the questionnaire**

From the signatures at the end of the questionnaire it was possible to determine who filled in the information and also to determine the place these people held in the school system.

The following list was compiled from this information:

- Shop teachers: 78
- Department heads of shops: 28
- Principals of schools: 11
- Persons in charge of department of visual instruction for school system: 9
- Those unsigned: 9

The following questions from the questionnaire 4, 13, 17, 19, 36, 37, 40, 41, 42 are the type that cannot be answered as a result of direct evidence. They, at best, represent the opinions of those persons filling in the information. The purpose for placing such questions in the questionnaire was to gather from a wide area some idea as to what the trend of thought is, relative to visual aids. Shop teachers and department heads of shops
filled out the greater percentage (78.4%) of these, thus the opinions are decidedly from the school shop standpoint.

Following are listed the questions as they were sent in the questionnaire and also the answers as they appeared in the returned copy. Notations are inserted by the compiler directly following some that were considered the more key questions to the situations.
Do you make use of visual aids for instructional work in industrial arts? 107 28

From this first question it is shown that 78.5% of the schools contacted are now making some use of the visual program in connection with their industrial work. This is an encouraging start due to the fact that there is so little published material calling attention to the numerous ways these aids may be used. The instructors who are utilizing these aids in their shop classes have no doubt realized their value and are experimenting with methods of making them serve more effectively.

Is your principal heartily in accord with a visual education program? 117 11 7

This question shows that 86.6% of the principals are in favor of having a visual program carried on in connection with the shop instruction.
The next three questions are somewhat parallel. It seems from the last question of the three that at present the most useful material is to be found in the motion picture film. This situation might be the result of more distributing centers from which films are available. Whatever the condition, it has led a larger number of the persons who answered the questions to conclude that the motion picture contains more educational value.
Which type of visual aids do you employ most?

Those answering were asked to signify the most used visual aid as first choice and the next most used as a second choice.

<table>
<thead>
<tr>
<th>1st choice</th>
<th>2nd choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass or film-strip slides</td>
<td></td>
</tr>
<tr>
<td>Motion picture films.............</td>
<td></td>
</tr>
<tr>
<td>Charts and diagrams.............</td>
<td></td>
</tr>
<tr>
<td>Photographs and pictures.....</td>
<td></td>
</tr>
<tr>
<td>Pictorial instruction sheets.</td>
<td></td>
</tr>
<tr>
<td>Manufacturer's exhibits......</td>
<td></td>
</tr>
<tr>
<td>Field trips.................</td>
<td></td>
</tr>
</tbody>
</table>

Graph showing relationship between first and second choice.
Which type do you think has the most educational value in the industrial arts field?

Graph illustrating instructor opinion of educational value of the various visual aids.

Glass or film-slides ...........
Motion picture films ...........
Charts and diagrams ..........
Photographs and pictures ..... 
Pictorial instruction sheets.
Manufacturer's exhibits .......
Field trips ....................
In which type of visual aids have you found the greatest amount of helpful material for industrial arts, to the present time?

Those answering were asked to underline the one with the most helpful material and also check the one next helpful.

Graph shows relationship between the two choices of visual aids.
Do you have trouble in securing suitable films for class use; films that are pertinent to your class discussions?  68 Yes, 36 No, 31 Not Answered

Have you a suitable list of slides from which to order?  40 Yes, 69 No, 26

Have you a good list of films from which to order those that you want in connection with your classes?  54 Yes, 57 No, 24

Does your school system own any glass or film-strip slides suited to your work?  34 Yes, 84 No, 17

Does your school own any films that are suitable for your classes?  19 Yes, 99 No, 17

Have you ever made slides pertinent to your own course of study?  27 Yes, 91 No, 17

The educational correlations in a project such as this are worth while. It will be a number of years before slides, either glass or the film strip, will be available in large enough quantities to make it possible to secure from exchanges those particular views that would be of greatest teaching value. The possibility of always having slides available that will illustrate the topic exactly is the best plan. For those instructors who wish
to become familiar with the correct technique in the making of illustrated slides to fit the course of study, this is possible. Such will eliminate the necessity, as at present, of building the course of study around available slides whether it is in accordance with what the instructor feels ought to be included or not. The reply to this question shows that 67.3% of those people who are using visual material have not yet begun to use this method of securing that closer relationship in the learning process between seeing and hearing.

Does your school willingly pay rental or carrying charges on visual material that you may want to use in the industrial arts department?  73 45 17

Do you think the cost of visual aids (transportation and rental) is too great, compared with their educational value?  35 76 24

If you were given a choice which would you buy for your shop? Those answering were asked to indicate their first choice of the
three listed.

The graph shows the percentages that chose the respective kinds of equipment. This also shows a relationship to some of the first questions asked in which the motion picture film was outstanding.

Motion picture machine...
Glass slide projector....
Film slide projector.....

The psychological effect of directed advertising toward the super-educational possibilities of the motion picture has no doubt caused many instructors, who have not made a thorough study of the subject, to over-estimate the motion picture as the ultimate in related visual aids. At present there are practically no films made with their entire aim as supplementary to the school shop course. Until it is possible to secure films, directed by industrial arts experts and entirely related to a more or less narrow subject, will such odds in the matter of purchasing differ-
ent pieces of projection equipment be justifiable.

**Are you able to secure sufficient good wall charts that cover equipment and material in your shop?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>51</td>
<td>12</td>
</tr>
</tbody>
</table>

**Do you take your students on field trips to industrial plants?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>34</td>
<td>15</td>
</tr>
</tbody>
</table>

The 65.2% of instructors who think it worth the time of their shop classes to visit various industrial and commercial plants can be taken as a fair cross section of conditions. The sampling of communities from which this information was gathered is representative of rural and city schools in sections of the United States.

**Do you consider the educational value of these trips worth the student's time?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>

The fact that such a high percentage of instructors do conduct field trips with their classes is an indication that they are considered good educational methods. The answer to this question shows that 83% of those who responded are of the opinion
that it is well worth the student's time to take such excursions. For many students it is the only chance of gaining access to industrial plants and seeing men working under actual working conditions. It also helps inexperienced students evaluate the school shop in its true relationship.

Have you ever had your students, either individually or in small groups, construct a scale working model or a boat, train, industrial plant, house, mine or anything of that nature? 74 50 11

If so, do you think it has possibilities as an educational device in our present school-shop setup? 78 24 33

Do you display any of the educational exhibits that may be obtained from various industrial concerns? 105 16 14

74.1% of the instructors make use of exhibits that the various manufacturing companies expend time and money in making available. There is, depending upon the subject taught, a considerable amount of very well prepared material. Business firms which sponsor such undertakings are desirous of (1) making pre-
sentable collections of raw products,
(2) showing various steps in the fabri-
cation of an article, (3) grouping fin-
ished articles from their plants, etc.
There is a definite cost behind the ar-
ranging and distribution of this mater-
ial and in the majority of cases someone
has been employed to sponsor this work
who knows how to prepare the material
from an educational point of view. There-
fore, it seems that a large number of the
shop instructors have discovered these
facts and are availing themselves of the
opportunity.

SURVEY OF EQUIPMENT AVAILABLE

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your school have a 35 M.M. motion picture projector?</td>
<td>75</td>
<td>44</td>
<td>16</td>
</tr>
<tr>
<td>Does your school have a 16 M.M. motion picture projector?</td>
<td>70</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Are these accessible for use in the industrial arts department?</td>
<td>95</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Does your school have a glass slide projector?</td>
<td>98</td>
<td>27</td>
<td>10</td>
</tr>
</tbody>
</table>
Does your school have a film slide projector?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>53</td>
<td>16</td>
</tr>
</tbody>
</table>

Are these accessible for use in the industrial arts department?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
<td>19</td>
<td>23</td>
</tr>
</tbody>
</table>

If your school does not own any or all of these items, can they be borrowed or rented from local sources, or from the state university?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>17</td>
<td>85</td>
</tr>
</tbody>
</table>

Those answering this question were asked to underline the equipment that it was possible to secure. The results were:

- Motion picture projector......24
- Film slide projector.........17
- Glass slide projector.......19

Do you have arrangements for showing films to shop classes without the necessity of taking the classes to a special room not under your control, and consequently not always available?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>84</td>
<td>7</td>
</tr>
</tbody>
</table>

The answer to this inquiry shows that of those schools represented 62.2% have not made provisions in their shops for using those visual aids that require a room which can be darkened. This approximates the situation that could be expected. A large number of the schools are using antiquated buildings that were constructed before the value of such a
room was common knowledge. As instructors become more alert to the possibilities of supplementary visual material, more adequate provision will be made for their uses.

Do you use films or slides to increase student appreciation of the field of industry?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>42</td>
<td>10</td>
</tr>
</tbody>
</table>

Do you attempt to give your students any appreciation of what our industrial development has been, by the use of films, slides or pictures?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>36</td>
<td>18</td>
</tr>
</tbody>
</table>

Have you used films or slides to give occupational or vocational information in the various industrial or manufacturing fields?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>41</td>
<td>14</td>
</tr>
</tbody>
</table>

Do you use films or slides to supplement your class discussions and demonstrations?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>55</td>
<td>17</td>
</tr>
</tbody>
</table>

Have you used films or slides to give direct instruction in shop subject-matter, rather than as supplemental to your demonstrations and discussions?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>99</td>
<td>6</td>
</tr>
</tbody>
</table>

Have you ever used slides for quiz or examination purposes?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>109</td>
<td>16</td>
</tr>
</tbody>
</table>

Do you hold your students accountable for the visual material that you show them?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>35</td>
<td>18</td>
</tr>
</tbody>
</table>
POSSIBLE VALUES OF VISUAL AIDS

In your estimation, does employing visual material speed up the learning process on the part of the student?  

This answer correlates with an earlier one in which it was shown that 78.5% of the schools were using some form of visual aids in their shop classes. This reply indicates that 87.5% of those answering are of the opinion that, by using visual material in a supplementary manner, the student learns more rapidly.

Do you believe visual aids make possible a better use of the teacher's time?  

Do your students respond enthusiastically to visual material used in connection with class discussion?  

Do you get good attention from your students while showing pictures and while on field trips?  

Do you believe your students develop any better methods of observation from a visual program?  

Do you think your students remember what you show them in class longer than what you tell them in class?
It seems that 69% of those responding are of the opinion that the visual method of presenting learning material is more lasting than the auditory method. This is a strong argument in favor of visual aids, regardless of the added time and expense it takes to prepare them in an educational manner.

Do you feel that your visual program has helped in making your teaching methods better and more effective?
A SIMPLE EXPERIMENT TO DETERMINE WHETHER HIGH SCHOOL SHOP STUDENTS LEARN MORE READILY AND RETAIN INFORMATION LONGER BY (1) VISUAL INSTRUCTION OR (2) THE USUAL LECTURE METHODS.

In view of the fact that there seemed to be some difference of opinion among industrial arts teachers as to the matter of a student remembering what he sees longer than what he hears, the author carried on a simple experiment to throw some additional light on the question. This work was carried on in connection with the regular teaching activities of the three year period 1933-1936.

Prior to the preparation of the set of examination questions the films were very carefully checked for (1) informational content and (2) the order in which this was given. This material was then put into lecture form, using as nearly as possible the same terms as those used in the films.

No illustrated material or demonstration apparatus was used during the talk except an occasional simple blackboard sketch and no information was given about any phase of the subject that was not shown and explained in the films.

Pupils of the two groups were permitted an equal period of time to ask questions about points that were not thoroughly clarified. The time necessary to show the film was used as a basis for the time devoted to the lecture. The best classroom atmosphere was estab-
lished particular to both types of presentation. Mention was never made to either group that they would be called upon to score the same set of questions several months later.

Students who participated in this test were of average high school age and mental ability. The I.Q. rating of each pupil was not recorded by the group averages from the Terman Group Test, Form A were 94, 103, 98, 97, 102, 101.

There was a total of 156 students during the six semesters of the three year period who saw the films for the initial examination. After a lapse of twelve weeks in each term there were only 151 of the original total left to be re-examined. Similarly, there was a total of 161 students who heard the talk for the first examination as compared with a total of 155 who were re-examined three months later.

The films used in this experiment were taken from the set "The Arteries of Industry" loaned by the National Tube Company, Pittsburgh, Pennsylvania. The introductory reel "Manufacture of Modern Steel Pipe" and the one depicting the "Seamless Tube Process" were chosen.

The following questions were given the two groups in exactly the same manner and each group allowed the same time for completion.
QUESTIONS ON THE FILM
"MANUFACTURE OF MODERN STEEL PIPE"

1. The records of early civilization show water was carried through what kind of material?________________
2. Approximately how long ago was the first wrought iron pipe manufactured?________________
3. In what locality of the United States are the large surface deposits of iron located?________________
4. What is the name applied to this type of mining?_______
5. What method is employed to transport the ore to the blast furnaces on the south side of the lake?__________
6. Why is the ore transported across the lake rather than refining it where it is mined?____________________
7. What is the essential function of a blast furnace?____
8. The blast furnace is charged with______, ________, in proportionate amounts.
9. The hot blast of air that is forced into the furnace comes from the ________________
10. The interior of the blast furnace is lined with____
11. The coke is put in the furnace charge for the following reason________________________
12. What method is used to prevent gas and pressure from escaping while charging the furnace?________________
13. At approximately what temperature does the reduction of the ore begin?____________________
14. At approximately what temperature is the iron completely reduced to spongy iron?____________________
15. Which is heavier--molten iron or molten slag?_______
16. How is molten iron conveyed from the furnace opening to the portable ladle?____________________
17. Approximately what percentage of impurities are in crude molten iron?________________
18. What is the chief difference between ordinary steel and pig iron?

19. What is accomplished by the Bessemer process?

20. What form do the impurities take during the "blow" in the Bessemer converter?

21. What is the approximate time required to complete the purification of a converter filled with molten metal?

QUESTIONS ON THE FILM

"SEAMLESS TUBING"

22. What are the approximate sizes of blooms used for making seamless tubes?

23. Are abrasions and irregularities removed from the surface of the bloom before heating it for rolling?

24. Why is a centering hole in each piece necessary before piercing begins?

25. What is the basis upon which a bar is cut to contain sufficient metal for a tube of a given size and wall thickness?

26. Name the four processes in the manufacturing of seamless tubing.

27. Continuous revolving and forcing of the centered end of hot stock into revolving end of mandrel is which process?

28. Is it only necessary to do the piercing process once for all sizes of tubing?

29. What is condition of the walls after this process?

30. What is done with the inside metal when a hot billet is pierced?

31. Formed rolls with definite size mandrel inside is which process?

32. What is the purpose of this process?
33. Pushing the tube through rotating rolls with a rotating mandrel inside is which operation? __________

34. What purpose does this process serve in the manufacture of tubing? __________

35. Finishing the tube to exact dimensions is called? __________

36. Uneven and rough ends of a tube are? __________

37. A ____________ is given each tube as it passes through the plant.

38. Seamless tubing is manufactured in what size ranges? __________

39. Why is a film of oil put on each tube before it leaves the factory? __________

40. Where are two places the seamless tubes are used in industry? __________
ANSWERS TO THE QUESTIONS ASKED

1. Hollowed out rock with clay binding joints. Hollow logs.
2. About 100 years.
3. North of lake regions.
4. Open pit.
5. Lake steamers.
6. Coal deposits on the south side.
7. Reduces iron ore to molten iron.
8. Coke, limestone, iron ore.
10. Fire brick, fire clay.
12. Two inverted valves working separately to maintain a constant closed opening.
13. 400 degrees.
14. 1475 degrees.
15. Molten iron.
17. 6%.
18. Carbon content.
20. Slag, gas.
21. 11-15 minutes.
22. 6"-8" square.
23. Yes.
25. Volume of metal in each.
26. Piercing, rolling, reeling, sizing.
27. Piercing.
28. No-larger twice.
29. Rough and thick.
30. Displaced to outside.
31. Rolling.
32. Either: Smooth and thin the walls, or Lengthen the tube.
33. Reeling.
34. Polishing inside and outside of tube.
35. Sizing.
36. Cropped.
37. Hydrostatic test.
38. 3/8" to 13 3/8" O. D.
40. (a) Boiler tubing.
    (b) High pressure steam tubes.
The tabulated scores for both groups are listed showing percentages of each group after information was given and also after a lapse of three months.

<table>
<thead>
<tr>
<th>Those who saw the film</th>
<th>Those who heard the lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.0%</td>
<td>69.7%</td>
</tr>
<tr>
<td>83.4%</td>
<td>87.0%</td>
</tr>
<tr>
<td>80.1%</td>
<td>77.5%</td>
</tr>
<tr>
<td>79.0%</td>
<td>74.4%</td>
</tr>
<tr>
<td>87.0%</td>
<td>80.3%</td>
</tr>
<tr>
<td>84.6%</td>
<td>79.1%</td>
</tr>
<tr>
<td></td>
<td>81.0%</td>
</tr>
<tr>
<td></td>
<td>Group Average 76.0%</td>
</tr>
</tbody>
</table>

After a period of twelve weeks in each case the same questions were presented in exactly the same manner as previously. The following data were recorded from those sets of papers.

<table>
<thead>
<tr>
<th>Those who saw the film</th>
<th>Those who heard the lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.7%</td>
<td>43.6%</td>
</tr>
<tr>
<td>67.1%</td>
<td>32.8%</td>
</tr>
<tr>
<td>59.8%</td>
<td>50.3%</td>
</tr>
<tr>
<td>57.4%</td>
<td>48.0%</td>
</tr>
<tr>
<td>58.0%</td>
<td>46.7%</td>
</tr>
<tr>
<td>64.9%</td>
<td>52.0%</td>
</tr>
<tr>
<td></td>
<td>60.1%</td>
</tr>
<tr>
<td></td>
<td>Group Average 49.2%</td>
</tr>
</tbody>
</table>

The results of this experiment indicate that the tendency is toward a slightly higher memory retention for those students who saw the films. The scores of the tests given show an 81% average for those who saw compared to 76% for those who heard. The tests given twelve weeks later show
a group percentage of 60.1% for those who were shown the films compared with only 49.2% for those who heard the information explained.

The conclusions from these data must be interpreted with the following information in mind:

1. The test was originated, given and scored by the same person.
2. The groups used were not very large.

The data listed are based on the results of a total of 623 students, 307 of which obtained their concepts from seeing the films and 316 depending upon the lecture method for their information.

The test results definitely show a tendency for better retention on the part of the student through the use of visual methods as compared to oral, the ratio being 81% to 76% immediately after the presentation in each case. More significant is the fact that the difference is even greater after a lapse of twelve weeks. The group average being 61.1% with visual aids compared to 47.2% for those who heard the factual material.

Were it possible to have eight or ten industrial arts teachers duplicate this experiment, each contacting as large a group of students, the results would show a tendency with a greater validity.

The ratio between group I.Q. and memory retention does not seem to follow an even curve. The group having the highest I.Q. seems to have retained the least over the elapsed period.
CONCLUSIONS AND RECOMMENDATIONS

"A sense experience may be mentally or emotionally intensive, or it may be intensive as sensation itself; or, quite obviously, it may be both. Clearly the desideratum is to combine mental or emotional intensiveness with physical intensiveness or the intensiveness of pure sensation."(2)

The study of visual material as aids in the school shops of the secondary level was undertaken for the purpose of determining:

a. How much is being done with visual material

b. What aids are being used

c. How instructors are presenting this material.

As a result of this study, the experiment conducted, and observations made of other teachers using visual material in their classes, the following points may be summed up as pertinent to the reader:

Conclusions:

1. Visual material in order to be beneficial to the student must be provided at the appropriate time in the development of the lesson.
2. Visual material must have a great deal of advance preparation by the person who is going to present it.

3. All material listed as visual aids, varies in its value as an educational tool and should be utilized discretely for different purposes and situations that develop in the industrial arts program.

4. The attitude and training of the teacher are the keynotes to the effective employment of any or all visual material.

5. Teacher training institutions must set up courses of instruction if the visual aids program is to make intelligent progress and be uniform in practice.

6. Use fewer but better visual aids during the development of a class topic.

7. The more well chosen, relevant industrial exhibits that become a part of the school shop program the broader will be the sampling of knowledge on the part of any participating student.

8. The course of study should be planned to include suitable visual material of known educational value.

9. Visual material should be thought of only as a means to an end and should be used, by the instructor, with that view in mind.

10. For the instructor who produces part of his own visual material, it should be remembered that to be educational to the adolescent mind there must be a center of interest.

11. The lecture method and the written page have only meaning to the student as he has acquired within his past experience the necessary sense perceptions which will function as a basis for interpretation.

12. A visual experience makes instruction meaningful; instruction clarifies this experience to a marked degree for the learner.
13. Since people learn through physical reactions to environmental stimuli and also by mental responses to challenging situations it seems evident that the visual aids can greatly facilitate learning. Instruction can be made effective in proportion to the instructor's ability to present opportunities for sensory contacts which multiply the experiences that will stimulate self activity.

In view of the fact that 68% of the instructors (from questionnaire, page 38) are of the opinion that a student remembers what he sees in class longer than what he is told should give some weight to the conclusion of such a question. The answers that these individuals gave were influenced by their observations of classroom efficiency.

14. The results of the experiment tend very definitely to show that the learning process is most efficiently carried through by student observation.

Recommendations

1. Have published in professional magazines, from time to time, suitable lists of films and other pertinent visual aids for the shop department. Points of value about the material and how it may be used in connection with class situations should be given. The distributor of this material should also be listed, with rental fees, etc.

2. That all school districts of a county subscribe to a central county fund for purchasing visual material for the schools of that county, thus keeping pace with the centralization tendency in handling visual aids.

3. That all plans for new shop buildings, and remodeling old ones, contain a room which can be darkened and used for projection work. The questionnaire shows that over 60% of the existing buildings have made no provision for this situation.

4. That professional magazines publish methods of using slides for giving tests and examinations. By this procedure a more nearly uniform situation could be set up throughout similar shops
of city systems. The questionnaire results state that less than 20% of the teachers are at present using such methods.

5. Judging from the data collected through the questionnaire and from the results of the experiment carried on in the class work it would seem expedient educational practice to put into visual form more factual material for the shop classes than is now being done.

Recommended Usage of:

Motion Picture
Where action is of paramount importance.
Where the movement of related parts or objects is necessary in order to make the situation meaningful.

Slides
When making comparisons by alternate images.
When image is to center on one interest point.
For concentration rather than entertainment.

Graphs
When comparing groups of numbers.

Field Trip
When students should observe actuality at close quarters.
When seeking associations between theory and practice.

Maps
When localizing localities which produce specific natural resources.
When discussing modern engineering accomplishments.

Educational Exhibits
When associating concrete objects with theory.

Flat Type Picture
When no other visual materials are available.
As a means of displaying to the student current clippings of interest.
BIBLIOGRAPHY


7. Freeman, Frank Visual Education. The University of Chicago Press, 1924

8. Pittsburgh Public Schools, Charts taken in part from their standard form chart.

Principal Sources of Visual Aids Particularly for Films and Slides

1000 and One Films, 12th Edition, 1936-37, The Educational Screen, 64 Lake Street, Chicago.


Lantern Slides and Film Strips of the United States Dept. of Agriculture, Washington, D.C.

Motion Picture Bureau, Y.M.C.A. 347 Madison Ave., New York City

Society of Visual Education, Inc., 327 S. LaSalle Street, Chicago.

Victor Animatograph Corporation, Davenport, Iowa.
APPENDIX

SUGGESTED METHODS OF PRESENTING VISUAL AIDS

IN THE SCHOOL SHOP
THE MOTION PICTURE

In listing achievements of progress of the human race, the motion picture would probably be recognized as among the first in the group. The influence on the illiterate as well as the intelligent is profound and its motion affords to many persons their only close-hand observations of the world beyond their immediate surroundings.

The actual experimentation and research that made possible the first moving picture covered many years and is a fascinating story. The persistence of vision in the human eye enables us to see an object for as much as 1/16 of a second after that object has been removed from view. Upon this basis scientific minded men concluded that if that were the situation and if some means could be devised to produce a series of pictures and then be able to flash them before the eye in rapid enough succession one picture would carry over into the next to the extent of producing the illusion of continuous action.

Inventors and research people kept constantly at the idea in various parts of the world but the greatest obstacle was the glass plate. After various cameras had been perfected which could take several exposures per minute through the same lens there still seemed to be no way of utilizing the bundlesome and breakable glass plate. Not until George Eastman of Rochester, New York, produced,
in usable form, the flexible celluloid film in 1889 that the real success of all this experimenting was reasonably assured. Thomas Edison made what was called the kinelograph, really a camera for taking pictures of motion and using this strip film that could be unrolled. In 1893 he had perfected the kinetoscope, a machine for showing these pictures. Historical writing call these the first motion pictures, but they were in reality not so. This was only capable of letting one person look at a series of pictures, more or less life like, through a magnifying glass. This was enough to build enthusiasm among other experimenters who had been working along the same line; until in 1896 the first public motion picture, thrown on a screen, was shown in New York City.

Step by step have been added new developments which are making it both more effective and useful. The advancement in microscopic photography now makes it possible to produce pictures of as much as fifty thousand magnifications. With that phase well under development came the telescopic attachments for photography at long range. There are numerous places where that type of equipment is serving a pertinent place in modern motion pictures. Then came the perfection of the X-ray by means of which we are able to see action taking place inside opaque objects. Then slow motion pictures with their educative possibilities and a more recently developed process of taking as high as 2000 pictures per second. All of these processes are able to contribute
in a very material way to the success of the motion picture as one of the visual aids.

The possibility of fifty thousand magnifications makes pictures of the structure of steel, cast iron, alloys, wood, etc., possible. Such scenes tend to dispose of the mystery of cell structure in the piece of wood, grain formation in a piece of carbon steel, etc.

The ability to record hundreds of pictures per second makes it possible to show at a slow and understandable speed the intricate working position of parts of machines that normally travel above the speed of vision.

The time elapse method of photography makes possible pictures of plant growth as well as fatigue action, fracture lines, breaking, etc., in materials. All these add directly to the industrial arts viewpoint.

The X-ray brings to the group some knowledge of how imperfect castings, fractured material, etc. can be detected before they are put to use. Many more instances could be cited but these will serve to illustrate the practical applications of such photography.

The motion picture as an educational instrument can be adequately justified. The following are examples:

(a) They afford an accurate record of just what the student sees, in the usual as well as the unusual, and provide a permanent basis for comparison at any time.

(b) They reveal their records in terms of actions,
indispensable where action is of essence and extremely helpful even though the subject matter is of a static nature.

(c) The material can be easily presented with equal effectiveness whether shown to one person or a large group. Every member of the class can enjoy the results for the same amount of energy expended.

(d) Correlated material of the most varying content can be shown in the proper sequence thus establishing a relationship. Nothing is too large nor too small and nothing moves too fast nor too slowly to be caught and reproduced by the films.

(e) Motion pictures may be more illustrative than the original itself, for example, resorting to animated drawings or models, by exaggerated contrast, by slow motion or time-elapse photography and by directed attention via the proper choice and inter-relationship of image sizes and planes of sharpest focus.

(f) A film enables an outstanding authority to present his work for class enlightenment where his presence would be impossible.

How to Present a Motion Picture Film Before a Class Group

Regardless of the film under consideration, it cannot reach its highest value as an educational stepping stone unless the teacher understands the technique of putting the film to use. At present only a percentage of
the so-called educational films show more than a part of what the pupil should know of the subject.

There should be a synopsis available with each educational film and preferably this should be in the hands of the teacher three or four days in advance of the film's showing. This gives the teacher a chance to decide whether the film is suitable for the shop class. One factor in the present attempt at using motion pictures is too little difference in the relative preparation of teacher and pupils, with the result that both are equally unprepared as the picture proceeds. It is poor practice to show a film to a group of students unless they are mentally ready for it. They must have reached a place in their project development and related information content at which they feel a need for the descriptive material the film can offer. Any film good as it may be, would have meager effect otherwise. "Although films may occasionally be used profitably to stimulate interest in new subject matter, actual tests have proved that only general impressions are gained, not genuine knowledge."(5:61) It must not be overlooked at any time that until growing boys are in need of information they are not interested in obtaining that material.

To balance the added costs of this type of education the instructor must know in advance the exact and full content of the film. The method to that end should be a careful analysis before student time is taken with its showing.
This teacher analysis should be in the nature of examination and expansion of the material. If it is possible to obtain this information some time in advance of the anticipated showing, there is a possibility of assigning some related reading to the class. This reading matter should, however, be available in the shop and not depend upon the student going to the library for it.

Presentation of the Film

During the actual presentation of the film, and this should be conducted in the darkened lecture room of the shop, the person in charge should utilize the information that has been accumulated from the previous preview. By having a definite knowledge of what is going to be shown to the class, the instructor can: (1) successfully add comments to various scenes, (2) point out particular action that is not sufficiently emphasized, (3) add a word of explanation here and there to tie up the continuity of the action.

These insertions by the teacher by all means should not be verbose and must be done at the proper time. Carefully plan the minimum number of interruptions in order that the observer may get the fullest value for the time spent. It must be kept in mind that the student spectator is one with a very limited background, thus choice of explanation is of more value than volume of explanation.

The newer projectors are arranged in such a way that
stopping the films and making a "still" of any individual frame is possible in order to provide adequate time for explanation and discussion of interesting sections of the material. This plan is highly advisable. It goes without doubt that slow members of the group will not benefit by the showing of new material unless precaution is taken to help them understand step by step what is before them.

After having presented the material to the class it is not good teaching technique to consider the job finished. Either a portion of the period the same day, or at least the following day, a comprehensive discussion should be carried on relative to the material. When the teacher is going over the film the first time it is beneficial to list a series of questions that are answered by the film content. After the class discussion these questions should be used as a check on the teaching method as well as to see if the intended meaning of the material was conveyed to the group.

The showing of the film as an end in itself is not sufficient. However, their legitimate use will stimulate students to clearer thinking and the desire for additional information; also it will help strengthen their capacity of observation. Through the use of good films it is possible to bring to the shop scenes from far away activities and show them more intimately the industrial processes of their community.

It should be considered a duty by all shop teachers
to coordinate the program with other departments of the school when possible. Manipulative training the student receives should not be thought of as an isolated part of the curriculum. Such should be made the integrating link between the more abstract subjects and his creative activities. A student cannot develop job intelligence nor job judgement unless the experiences are widened.

If a film is worth while and has value from an educative viewpoint it is worth showing so the upmost value may be secured by all who see it. The instructor taking this attitude may be benefitted by constructing an integrated outline for the best films used during the school year. The extent to which this sort of procedure is helpful will depend upon local conditions, student group capacities, library facilities, etc. Following is an example of such a plan:

An Integrative Plan for the Presentation of Educational Films in the Industrial Arts Departments of Secondary Schools

A film suitable for any department of the shops might be chosen with equal results but for purpose of example one dealing with the gasoline motor will serve to illustrate a tentative outline.

I. TITLE - "STORY OF THE GASOLINE MOTOR"

The preview by the teacher of the film will disclose that it contains abundant animated drawing to clarify the separate functions of each
part of the motor, information about their construction and operation, provision for lubricating each unit of the motor, etc.

Briefly tabulated, this information will make it a simple matter to correlate step two.

II. CORRELATION OF THIS MATERIAL WITH OTHER SCHOOL DEPARTMENTS

A. Science

Students can be encouraged to list all scientific applications found in the gasoline motor. Scientific applications of laws of work, conservation of energy in design, etc.

B. English

Too many secondary school students fail to grasp the significance of the study of English. This is due, possibly, to lack of interest which is the result of not being able to readily visualize the connection between the efficient use of language and every day occupations. With few exceptions, boys are concerned about the working of the internal combustion engine, thus with less effort it is possible to have them write an interesting English theme on the topics of the automobile.
C. History

A study of important incidents leading to the successful smelting of iron ore, steel making, alloy making, present production of automobile lubricants, etc., all have historical value. Such topics could be as much more detailed as desired. Material similar to this presented from the historical standpoint will be interesting and help destroy the barrier between secondary school students and the study of history.

Topic correlation could be listed further but these few will illustrate and clarify the procedure.

III. AIMS

A. To show modern production methods of manufacturing gasoline engine parts. To show how these parts fit together and perform separate tasks for the efficient running of the engine.

B. To create a desire to learn more of the operation of separate parts of the engine. To learn more of the correct lubrication of the automobile motor which will increase its useful period.
C. To develop an interest and appreciation for well designed machine parts.

IV. CONTENT

A. The modern production processes in the manufacturing of engine parts.

The instructor can compile a list of available references for the shop library that will enable the student to gain in detail, information on these topics. This list should be in the form of a file system that can be revised for new references. Over a period these lists should become quite complete and add materially in supplementing the films which would be shown.

B. Materials

It would be beneficial also to file references on the materials used in making the gasoline engine. Such topics as:

1. Iron ore
2. The smelting of iron ore
3. Steel manufacturing
4. Curing cast iron before machining
5. Rust—its cause and prevention
6. Coal and coke
7. Lubricating oil
8. Alloy steels with special properties.

Numbers of interesting and informational topics are published which when presented in connection with visual aids make for a fuller education, especially for those whom high school is the last formal training.

V. PRACTICAL INTERESTS GROWING FROM THE STUDY
A. There might not be much practical interest to arise from this film but most films shown to departments of the shop may be the direct cause for students becoming interested in the construction of worthwhile projects and following up additional information.
THE STEREOPTICAN OR LANTERN SLIDE

In a discussion of the uses, abuses and teaching value of the stereoptican slide it should be mentioned that the discussion will cover both the older style of glass slides and the newer development, the film slide. There are advantages to both but other than the fact that there are made up, and ready for distribution, good sets of glass slides the topic could be confined to the newer methods.

The older style commercial slide consists of uniform sized piece of glass upon which has been developed a photograph. This is a positive print to insure the contrasts of the scene being logical. They compare very closely to the photograph except being on glass instead of paper. To add protection against scratching the emulsion, another piece of equal size glass is placed in such a manner that the emulsion side is between and the two are bound together at the edges with tape.

The film slide has advantages over the previous type. They require less storage space and are much lighter which facilitates transportation from distributing centers to schools. Essentially these are pictures printed on a positive strip of standard 35 M.M. non-inflammable motion picture film. There may be from 50 to 100 separate pictures on a single strip depending upon the length for convenient handling.
The improvement of stereoptican projection equipment and the introduction of the mazda lamp light source now enable these to be handled in any class room with the minimum amount of inconvenience. These have been perfected to the point where darkening devices are not needed. The regular window shades drawn and the projector placed near the front of the room will give excellent results if a satisfactory screen has been provided. When planning for the slide as a teaching aid, it should be remembered that the less difficulty involved in getting ready to show the class the slides the more efficient it becomes.

Advantages of the Still Picture

The shop instructor not versed on the merits of visual aids may be inclined to believe that since the development of motion pictures the still picture has no place in the school curriculum. This is truly a popular conception but also an erroneous one. There is really no common basis for a point by point comparison but with respect to the moving picture there is still ample place in the course of study in the most modern shop for the slide.

(a) one of its best uses is the ability to show alternately different images for the sake of making adapt comparisons.

(b) The slide image may be placed on the screen and left there as long as the instructor wishes in order to
complete the points about which the class discussion is centered. True, the modern motion picture projectors can be stopped to make a still scene of any individual picture on the film but of necessity it is not possible to work those out into a complete unit that will take the place of well organized slides.

(c) It is quite easy to return the slide to the screen again. This may be done during the course of a class discussion as well as a week or a month later in order to clarify points students have misinterpreted.

(d) Should the teacher attempt to use motion picture films to fit a course of study it would of necessity be the content of these available films that would be the basis upon which to set up the various units of instruction. With the slide as the visual accomplice it is more reasonably assured that what is wanted can be illustrated. This is becoming constantly more the case.

Shop teachers and department heads are coming to be better qualified to make their own slides, thus illustrating precisely those points in the related material that they want. The very fact that the image presented remains quiet allows the class to discuss and study the pertinent points.

(e) In starting the discussion of a new unit of shop work often a few well chosen slides may serve as an interest stimulant. This is only possible where the shop or school owns its own slides or better where those slides owned by
The school are made to fit exact situations in the course of study.

As an example:

**Class in Elementary Wood Working**

The discussion is brought about, by the teacher, as to various kinds of joints that are used in fastening wood together. It would be possible to give the group a talk using a small wooden model of each joint and make a fairly good presentation. However, if this same teacher has either made or had made a set of 6 to 12 well balanced and informative slides that can be projected before the class as a basis or as an aid in promoting the discussion, he has helped those boys build an appreciation of the connection between the joints they are going to construct in the class and the place they could be used on the actual job. It is not always possible to take the group to a nearby building, under construction, to show them carpentry practices.

Teachers, under ordinary circumstances, know they will be teaching those same fundamental units year after year to new groups of boys and there seems no logical reason why they should not consider the gathering together of these small sets of informational slides as much a part of the teaching equipment as many of the other "gadgets" collected.
Points to be Avoided When Using Slides as Instructional Aids

(a) Slides should be of good quality. Do not waste student time by showing poorly made slides. By that is meant those that are too dark to allow a good clear image, those with hazy line drawing and those with incorrect representation of the subject. Projection of slides that are cracked badly, or scratched if of the film type, are not suitable and should be replaced.

(b) The content of any slide should be arranged around a center of interest, pertinent to the topic. Let it be hoped that no shop teacher will rent a set of slides and show them to the class without first going through them himself. There are few sets of slides procurable at present from rental exchanges that contain slides all of which are directly connected to any one narrow topic. For that reason it is much better that individual shop systems either buy, by close selection, or make, under careful supervision, their illustrated material. It is poor pedagogy to detract in any way from the specific unit that is to be highlighted. For example, should the discussion be about a particular type of antifriction bearing and its use in the automobile, it would be useless to use a slide showing the bearing in working position if it were in the most inconspicuous part of the picture. The point of interest should occupy the paramount position from the standpoint of position in the arrangement and
from color contrast. The color may be accomplished either by tinting or line shading.

(c) The correlative slide will best serve its purpose if discretely used. Do not call a group together too often and repeat, as though by formula, the same slide illustrated procedure for each new topic discussed.

(d) It is a mistake to use a large set of slides covering scattered parts of any topic. Individuals do not master new material as well by seeing a maze of somewhat related subject matter as they do by concentrating upon one phase of the material until well understood and then proceeding to another. It is for this reason that scattering the learning unit over a large group of only partly connected pictures is bad practice. The untrained mind, which teachers are dealing with, does not grasp many of the relationships and consequently does not follow the theme of the illustrations. When using picture material to aid definite learning processes, concentrating the content is necessary. If one wishes to use this same material as a basis of entertainment, it is best to use a wider range with less concentration.

**Evaluation of Slides**

The person making slides or selecting them from a prepared list should be guided partially by the ensuing points:

(a) Truthful: Is the picture true to the facts
and relatively free from distortion or illusion?

(b) Relevancy: Do the facts illustrated pertain to the topic to be illustrated?

(c) Concentration: Does the central fact or the one for which the picture was taken stand out clearly in relation to the many other details?

(d) Technical quality: Are the images well defined particularly in the shadows and are the slide faces free from blemishes such as stains, scratches, etc.?

(e) Interpretation of size: Some means should be provided to allow the learner to make a size comparison of the unknown object with some already familiar object.
Situations arise in class discussions in which comparisons should be shown. Placing large numbers on the blackboard before a group of students will not give the same effect as presenting the same facts in graph form.

There are a variety of methods of making a graphic chart that will represent either:

(a) a single fact
(b) a group of facts
(c) possibly an idea.

There are several forms in prevalent use and an understanding of their differences is briefly cited. There are in practical use three types of graphs, specimens of which may be seen in any text book. These are listed as

(a) the curve
(b) the bar graph
(c) the circle graph.

The bar graph, due to its simplicity, ease of construction, accuracy and understandable nature is possibly the most practical for school use. This form of graph utilizes two or more parallel bars or rectangles and may be arranged either vertically or horizontally but must of necessity always start from a base line representing a zero point. The comparative lengths of these rectangles are meant to represent given values. The eye is trained to read in the horizontal direction so for that reason
authorities contend that if speed and accuracy are to enter into the understanding of this type graph it should be the horizontal bar style. Coloring of these bars sometimes adds to their value.

The bar graph finds its largest use in representing comparative sizes, distances, values and the quantity of output by competing industrial concerns, etc.

There are two possible methods of employing the graph as a visual aid in the industrial arts course. Many firms will furnish material relative to their industry in graphic form which may be submitted to the students to show comparison. Also it may be beneficial to have students construct their own graphs to illustrate material they wish to present before the group.

Another form of graph in general use, but not to be used in situations where extreme accuracy is desired, is the circle representation. These are intended to give comparative ideas only. However, the student being used to thinking of a circle as representing a whole it makes an effective visual means of displaying various facts. The circle should be sectioned into various colored or shaded parts, each carrying a weighted idea. These separate sections, whenever possible, should be made to represent percentages of the whole. Let it be supposed that the teacher wanted to show in a commanding form the amount of salable timber still standing in the various
sections of the United States. Rather than place four or five sets of figures before the class a circle graph could be easily and quickly made showing this data in an understandable and comparative manner.

The curve graph which is used so widely in the industrial world is a type that lends itself most proficiently to a very high degree of accuracy. If the material to be represented demands this degree of precision this would be the most acceptable.

One method that would be sure at least of teaching the student the fundamentals of graph making could be carried out as follows. It should be a part of the teacher's work to carry on organized objective tests at regular and frequent intervals to check on instructional methods and to stimulate students to better effort. A properly arranged card given to each member of the class with instructions for transcribing these test scores into terms of curve representations, over the semester period, would induce a desire to keep the curve going upward and also teach the principles underlying this method of graph building.

Some suggestions are necessary in instructing persons in the method of graph making.

(a) In plotting graphs, this as well as all other types, accuracy should be emphasized. In order to expect this a steel scale and a sharp hard pencil should be used.
(b) All graphs should be neat. A well made presentation gives a better impression than a dirty, shady lined graph.

(c) Accurate measurements should be encouraged both in horizontal and vertical lines.

The graph depends upon accuracy for its usefulness and one that is inaccurately made presents misleading conclusions.

There are various other types of graphs suitable for educational purposes but are not so readily adaptable to this particular program. The instructor, however, should be on the watch for illustrative material of the sort that may in some way help illustrate and enliven material for the boy. There are available from scattered sources Picture Graphs that might help in various ways. The cartoon, though thought of as in the realm of entertainment, can occasionally be inserted with credible results. Whatever the graph, if it depicts a true comparative picture it most certainly has a definite function to perform in the present shop program.
THE FIELD TRIP

It should be clearly understood that the field trip is not an event taking place on weekends or after school hours. It is treated in this thesis as a part of the regular teaching program and should have a definite place to fill in the instruction. Students are to be taken from regular shop periods out to the source of information where they may observe actuality at close quarters. Comenius recognized this fact when he said, "People must be taught to get their knowledge, as far as possible, not from books but from the earth and sky, from oaks and beaches". (1:28)

The picture program, either still or in motion, does not take the place of the field trip if we are seeking associations. It is this intimate association with the industrial plants, manufacturing operations, etc., that becomes the actual experience of the growing boy. Education recognizes that personal experience is, after all, the best teacher and combining this with the natural industrial atmosphere and environment of the worker, it contributes very materially to those vivid and lasting impressions.

It is on a trip that the artificial school shop atmosphere is dropped and instructor and students have a common goal. The teacher has an opportunity to gather personal information about the boy and a chance to direct, in an informal way, good citizenship training. It is one
of the most pertinent methods of tying up school work with life out of school.

Before going more thoroughly into the types of field trips, it should be understood that this sort of work has definite limitations. It can hold a lofty place in teaching but never considered more than a step in the process of developing the course of study. There are many class topics which the field trip does not serve as the best visual aid. For example, when in the sequence of related information it becomes time to elaborate on the various methods of smelting iron ore and converting into steel, a more lasting impression could be made by using the animated motion picture. Being impossible to see what is going on in the furnace or converter, to show these processes step by step in slow motion with explanations serves more efficiently. It is in such instances as this that modern photography excels the naked eye and explains intricate processes in a commendable way.

The following types of trips are well worth their time:

(a) Trips to industrial plants.

(b) Trips to some locality for the purpose of first-hand information on natural resources.

(c) Trips to industrial museums.

**Trips to Industrial Plants**

Every individual should be trained to be interested in how such commodities as food, clothing, shelter, luxur-
ies, etc., are made. It should be a functioning part of school shops to see that boys are given opportunities to visit manufacturing plants, factories and mills in order that they may gain, first-hand, ideas important to the production of these various items. It is not sufficient to tell about the processes involved in making paints, nor how the belting that runs the machine in the shop is manufactured. Better and more appealing methods should be devised to stimulate thinking in concrete terms. The junior or senior high school boy should come face to face with factory workers laboring in ill-ventilated, crowded and often health hazardous conditions in order that the rest of the population may enjoy the results of what that plant is making. Such situations give an inkling of vocational guidance and an appreciative understanding regarding social and economic problems.

Trips to a Locality for the Purpose of First-Hand Information on Natural Resources

Usually within a radius of a few miles from the school plant can be found some natural resources of value for the shop group or better yet the general education viewpoint. The background of experience being limited for most of the youth, it would be well to develop an understanding of what natural resources are, what prevalent methods are in vogue as to obtaining these in the most economical manner and an idea as to how they are utilized in industrial channels. Some localities are more fortunate than others but the
progressive teacher will find something to serve the purpose within a reasonable distance. The lumbering industry, the mining of iron ore, coal mining, oil fields and refineries, copper mining, water sheds and irrigation projects all or in part could fill such qualifications.

**Trips to the Industrial Museums**

This is impossible for many but a worthwhile venture for those who can. City school systems are in an excellent position to foster such a plan. An appreciation of development relative to many branches of industry should be gained by the student on such tours.

**Organizing a Field Trip**

Organizing a field trip in relation to educational aims is a real task. Its effectiveness depends on the preparation of the students and upon efficient planning. To let any class wander aimlessly through a plant is criminally wasteful of school money. However, to insure a successful trip the following procedure might be used as a guide.

The general shop class in which a very incomplete aluminum foundry exists is discovering that the majority of the machines that are worked with every day are entirely or in part made from cast iron. The supposition as to how these various shapes and sizes are created becomes quite a problem. In order to obtain this information a trip to a
near-by commercial iron foundry is decided upon. The teacher should give these students, by various methods, information on all the activities that will be seen while there. This must, of necessity, be given in relation to students' lack of background on the subject. Points for study might include:

(a) The nature of iron in its molten state.

(b) The amount of heat necessary to bring iron to a molten condition. What the slag is and how it is disposed of.

(c) Information concerning foundry sand, how and where it is made, its duration of usefulness, mechanical methods of handling, etc.

(d) Core sand, cores, core ovens, means of breaking baked cores after use, bonds, etc.

This discussion should be carried through for all the major topics of the plant. Individual research by students, concerning these various phases, should be given as reports before the rest of the group.

It may require several days of work in preparation for the trip. During that period the instructor is creating a feeling of anticipation and doing some practical teaching.

Before going the group should formulate a list of questions to be answered while going through the plant. Each pupil should make an attempt to search out the answers during the trip.
Other points of caution in undertaking a trip are:

(a) The instructor should be familiar with the products of the plant to be visited and if possible familiar with the entire plant.

(b) Wherever possible, divide the class into small groups and let each unit have someone in charge who is in a position to fully explain and answer inquiries.

(c) Before starting, the teacher and each member of the group should have a definite plan and purpose for going.

The trip is not an end in itself, consequently the following day or two should be given to class discussion in which the impressions of both students and teacher will be pooled. The experiences should be discussed in an orderly manner and the results of the questions tabulated.

If a plan of similar nature is followed in undertaking each field trip, the results will be far reaching in student benefits. The preliminary work of preparing the student for what he will see gives him a basis upon which to reason. The results will show by his asking questions worthy of intelligent answers.
The majority of shop teachers (see graph from questionnaire) do not make use of maps in class discussions. There should be a place for such material in the related information program.

Raw material, from which our daily existence depends, is a topic that should be enriched for students from different viewpoints. In the related information program, which should be a very definite part of the sum total of experiences the boy contacts, the vital importance of raw material must be brought to the attention of the group.

The inclusion of maps will help localize localities from which these materials come, such as the marketable timber areas that are left. There are other maps that will show in a comparative way where the iron and coal beds lie. Also there are others that well show where industry is obtaining other mineral resources.

It is not enough to tell a class that it takes coal and iron to produce a large manufacturing center. Illustrated maps showing these locations in conjunction with other maps showing the centers of population that depend upon such industrial pursuits make for the type of discussion that should be taking place in the school shop.

Attention and discussion concerning engineering development in the form of these outstanding projects that command general interest should be given a place in
industrial arts. A rather valuable connection can be made for the group by emphasizing geographic conditions and the location of these various projects. Maps can be successfully utilized to this end.

The preceding suggestions are only a few of the possible places maps may help. Maps should be considered as a part of the material that goes toward better educational results, obtained and cared for from that standpoint.
EDUCATIONAL EXHIBITS

The industrial arts teacher should have as an objective the intimate acquaintance of students with the industrial output of the world. There should be an attempt to build within the boy's mind an appreciation of manufactured products, if from no other viewpoint than as an aid in furthering consumer knowledge.

Situations are not always such that it is possible to use the field trip as a means of expanding the group's horizon of knowledge through actual observation and experiences. Much of the material that students associate within daily work is produced in scattered sections; thus as a substitute for taking the group to its source, procure an exhibit from the manufacturers. The exhibit contains the concrete object with its real size and three dimensions and the student should be allowed to become thoroughly familiar with such material by actual handling.

Showing a film or some slides that depict the rubber industry from plantations to tires will give valuable impressions to the class but far better would be an exhibit of raw rubber, cotton fibre woven into cord, sections of finished casings and other such material directly related. Material of this sort that may be felt of and talked about will be of immediate use. Small exhibits can be accumulated from time to time and should be considered and cared for as any other valuable teaching aid. These can be used for a
number of class discussions on the subject over an extended period.

There are some first grade exhibits of stimulating educational nature sponsored by manufacturing concerns. These are prepared partly from a selfish standpoint, but this point has to be overlooked due to the valuable material that is brought before the shop groups. Much teacher time can be consumed in gathering up good material that can be displayed. For that reason it is better to utilize, wherever possible, the results of these larger concerns. The majority of prepared exhibits are not complete enough in themselves to go without explanation.
PICTURES OF THE FLAT TYPE

Should all the previously mentioned visual material be unobtainable there are still several sources that afford usable and valuable help for the teacher who wishes, in some measure, to illustrate and enliven the course.

Every shop has some conveniently located space that will hold a 24" x 48" bulletin board. Students should be periodically reminded that there is worth while material upon the board and it becomes a duty of that teacher to see that there is helpful material placed there from day to day.

Sources for such material can include:

(a) Cuttings from magazines, newspapers, books.
(b) Drawings from magazines, newspapers, books and pamphlets.
(c) Mechanical or sketch drawings illustrating many interesting things to the groups.
(d) Photographs. These can be gathered from varied sources. One excellent plan is to enthuse pupils to the idea of bringing photographs of worth while nature and apropos to the shop atmosphere.
(e) Charts.
(f) Posters.
(g) Postcards.
The important thing about handling a bulletin board is to maintain student interest. Nothing will kill this interest faster than leaving the same material posted over a long period. The adolescent wants to see new material that contains facts of interest to his level of thought.

Teacher explanation to the group concerning points that may not be quite clear is advantageous. The asking of a question during an examination that centered around poster material also aids in maintaining interest and keeps pupils on the watch for that volume of interesting material that can be displayed.

Observe the following points for the bulletin board:

(a) Keep the bulletin board neat. Clippings orderly in form and mounted on a back board before posting is good technique.

(b) Cut pictures straight on the edge and arrange in pleasing form.

(c) Only clear meaningful photographs should be displayed.

(d) Drawings exhibited should be neat and should this material be mechanical drawing only those of a standard quality should ever find their way to the board.

The bulletin board should become a part of the shop program and one that will constantly benefit the observer, in fact it should be of such interest that every student will visit it every day.
SAMPLE SCORE SHEETS THAT MAY BE FILED FOR REFERENCE

By the use of such sheets it is possible to select available material that is most suitable for the situation.

VISUAL EDUCATION FILM RECORD CARD

<table>
<thead>
<tr>
<th>Title</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Film is of Special Interest to Depts. Checked</th>
<th>Comments</th>
<th>It Correlates With These Subjects</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Shop</td>
<td>Geography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocational Information</td>
<td>U. S. History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabinet Making</td>
<td>European History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drafting</td>
<td>Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto Mechanics</td>
<td>Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printing</td>
<td>Civics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone Work</td>
<td>English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Shop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundry</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RECORD CARD FOR FILMS OR SLIDE-SETS THAT CAN BE FILED FOR REFERENCE

Title ____________________________
Number of reels or slides____________
Date of viewing ____________________

I. Composition of Theme
   A. Center of interest.
   B. Unity.
   C. Clear and significant ideas.
   D. Truthfulness.
   E. Elements of appeal.
   F. Simplicity.

   Excellent     Good      Fair     Poor     No Value

II. Pedagogical Value
   A. Relevancy.
   B. Vividness.
   C. Mental Stimulus.
   D. Correlation with normal experiences.
   E. Authenticity--reliable source.
   F. Economy of time and effort.

   Excellent     Good      Fair     Poor     No Value

III. Ethical Value
   A. Treatment of social relations.
   B. Freedom from objectionable language.
   C. Arousal of desirable emotions.
   D. Inspiration toward worthy ideals.
   E. Stimulation to worthwhile activity.

   Excellent     Good      Fair     Poor     No Value

IV. Mechanics
   A. Good definition.
   B. Correct distribution of color and shade.
   C. Titles and subtitles clear, simple, and artistic.
   D. Freedom from blemish.
   E. Percentage of proper descriptive material.
   F. Subtitles within range of pupils' understanding.

   Excellent     Good      Fair     Poor     No Value