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## Dual Organization Of The General Shop With Related Subjects

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DUAL ORGANIZATION OF THE GENERAL SHOP WITH  
RELATED SUBJECTS



FRANCIS

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DUAL ORGANIZATION OF THE GENERAL SHOP  
WITH RELATED SUBJECTS

By

Luther V. Francis

A Thesis Submitted in Partial Fulfillment  
of the Requirements for the Degree of

Master of Science

In The

Graduate Division

Industrial Education

School of Engineering

Prairie View Agricultural and Mechanical College  
Prairie View, Texas

August, 1952

DEDICATION

To my mother, whose untiring sacrifices and efforts have made possible this achievement in my life, I dedicate this Thesis.

L. V. F.



#### ACKNOWLEDGEMENT

For suggestions and advice, I wish to express my sincere gratitude to Mr. L. B. James and Mr. F. M. Graham for the interest and assistance in helping me to prepare this Thesis.



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## CHAPTER I

### INTRODUCTION

Dual organization of the general shop with related subjects, as the term applies to this thesis, will be construed to mean an organization combining within the department both the general shop and the related subjects that support the general shop curriculum.

These courses are normally handled outside of the specific department, and they include, for an example, such courses as Mathematics, English, Chemistry and Physics.

The following factors influenced the writing of this paper on dual organization of the general shop with related subjects. First of all, the writer has been made aware of the facts dealing with the problems encountered by shop instructors. It has been noted that the general shop has been widely used as a dumping ground for students who seem to be academically slow, and it is seemingly expected that the shop teacher can bring out the good qualities of these students, if they have any. Also noted was the fact that in many instances, not enough time has been given to correlation of subject matter.

#### Purpose

The purpose of this study is to set up a proposed scheme and point out its relative merits and advantages over the more conventional type of organization. The writer also



plans to determine how it can be organized and taught effectively in the situation which warrants its use, especially as it will apply to the Texas high school.

It is thought that if favorable conclusions can be reached on the basis of such purposes, we will have at hand a powerful educational tool that may well serve to stimulate the learning process in the general shop curriculum in the Texas high school.

#### Hypothesis

The nature of this type of thesis makes it quite necessary to establish premises on which to build its organizational framework. The writer has found it next to impossible to obtain statistical data on this particular subject. In fact the closest he was able to approach factual information was from an inquiry made to The Texas Education Agency from which the reply was negative. They stated that information on this subject was at the present not to be had, but that when such information is developed they would be more than happy to forward it to the writer.

In light of the situation, it will be imperative for the writer to project into this thesis much of his own original thinking. In order to do this, there are some rather vital assumptions that must be made. First, it is very necessary that the school have such an enrollment that would render such an organization workable. To be more specific the writer



would suggest that the school have a minimum enrollment of at least 400 students. The workability of this dual system is also dependent on an adequate school plant, a factor without which no system could function properly. It goes without saying that the dual system must be administered by a well qualified staff, in conjunction with a cooperative administration.

#### Method

The historical and philosophical methods were used in collecting and presenting the data as shown here in this thesis.

#### Scope

This treatise covers the organization, content, teaching devices, administration, principles and techniques in curriculum construction, and problems of dual organization of the general shop with related subjects.



## CHAPTER II

### DISCUSSION

In order to furnish the reader with an adequate background, the following discussion on the general shop has been submitted.

Organization and Content of the General Shop. The aims and basic teaching content of the general shop are in harmony with the best practices in the industrial arts field. Varied types of space and equipment organization have been tried and developed by shop teachers and supervisors in an effort to solve the problems of housing an adequate general shop. The general shop has found special favor in the junior high school and is heralded as containing the solution of the small town industrial arts problem. It has proved valuable as an educative and finding course for vocational students who have no shop experience upon which to base the selection of a trade. The general shop has encountered many real difficulties in its development, but is now rapidly gaining ground as a desirable concept in presenting the non-vocational phases of the shop program.

The marked trend toward the use of the general shop for teaching industrial arts is shown from the report of a survey conducted by Dr. Maris M. Proffitt.

If a single outstanding trend of the present were to be used to predict the future of industrial arts work, it would most certainly be the trend toward the organization of pupil experiences for



instructional purposes around the central idea of the general shop. Probably nothing in industrial arts work has shown the growth on a country-wide basis as has the general shop especially for the junior high school level. That this will continue seems to be beyond the shadow of a doubt. The reasons for this are obvious. The general shop form of organization: (a) Provides for a variety of media and consequently, of activities for pupil experiences in manipulative work for self-expression and exploratory values; (b) Provides an excellent opportunity for acquiring, in a realistic way, information about industry and our industrial society; (c) offers a large variety of activities that make it more nearly possible to provide pupils with experiences in accordance with their interests and developmental levels than does the unit shop; and (d) makes it administratively possible - due to the form of organization and the content of instruction that characterizes the general shop - to offer industrial arts in a larger number of communities than would otherwise be possible.<sup>1</sup>

The content of the general shop is composed of large basic areas of instruction representative of groups of modern industry. Woodworking, metalworking, drafting, graphic arts, ceramics, electricity, plastics, transportation, and textiles are the instructional areas which are most frequently incorporated into general shop courses. Most general shops are equipped to teach four or five of these nine basic areas and the selection depends upon the grade level, type of school, and the specific objectives of the shop course being offered.

Common practice in establishing a curriculum is to begin with a list of aims or objectives, and then forthwith to

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1. Newkirk, Louis V., Organizing and Teaching The General Shop. The Manual Arts Press, Peoria, Illinois. 1947. p. 16.



select arbitrarily a number of school tasks and projects which may plausibly be expected to fit in with the aims. The objectives may be broad and general, covering points which one would be obliged to accept "in principle", or they may be quite extensive and specific, running into a series of many hundreds of statements.

Bobbitt places all the major objectives in education in the following ten categories.<sup>1</sup>

1. Social intercommunication.
2. Maintenance of physical efficiency.
3. Efficient citizenship.
4. General social contacts and relationships.
5. Leisure occupations.
6. General mental efficiency.
7. Religious occupations.
8. Parental responsibilities.
9. Unspecialized practical activities.
10. Occupational activities.

Much of the work in the dual organization of general shop falls in the ninth group above, and this group is rather sharply distinguished in both theory and practice from the one which follows it. All of these activities are to be considered important throughout the curriculum, although emphasis may well be shifted as progress is made from grade to grade.

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1. Bobbitt, F., How To Make A Curriculum. Houghton Mifflin Company, Boston, Massachusetts. 1924. pp. 11-29.



W. W. Charters techniques for actual reconstruction of  
the curriculum is as follows:<sup>1</sup>

1. Decide upon the aims or objectives. These aims must be worked out with great care, for they are to have an essential bearing on the selection and use of subject matter. It follows that they must not consist simply of abstract ideals for which no corresponding school activities can be found. Ideals must be closely interrelated with activities.

2. Make a complete and systematic job analysis of the activities selected as desirable. Such analysis may lead to either "a list of duties or a list of methods of performing duties."

The types of shop organization embraced by the general shop cannot be adequately classified as unrelated, since all have points in common and the border-lines are not clear cut. Rather these shop organizations constitute a family, and the apparent differences are caused by modifications made to meet varied teaching situations. The type of shop organization for a given community is the one that will enable it to carry out a good general-shop program with the space, equipment, number of pupils, and teaching staff available.

The following characteristics are to a large degree<sup>2</sup> responsible for the popularity of the general shop.

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1. Charters, W. W., Curriculum Construction. The Macmillan Company, New York, New York. 1925. pp. 28-29.

2. Newkirk, L. V. and Stoddard, G. D., The General Shop. The Manual Arts Press, Peoria, Illinois. 1929. pp. 14-15.



1. It is well adapted to the organization of industrial arts content in the light of the general education, exploration, and guidance aims of the junior high school.
2. It permits students to be treated as individuals with due respect for their differences in interest and capacity.
3. It enables a student to discover his abilities and aptitudes through manipulation of a wide range of materials, tools, and processes.
4. It offers an economical way to gain experience in many activities.
5. It makes possible an adequate industrial-arts program for the small school.
6. It stimulates the setting up of a well-planned shop and a carefully-organized teaching content.
7. It increases teacher efficiency.

The general shop is well adapted to the junior high school. This is the period when pupils are making wide contacts with objects and materials. The pupils need information about the things they meet in the world; they need the experience which comes from handling and knowing these products. They also need to try their skill at manipulating tools and materials. They need to learn how to care for the electrical and mechanical devices about the home and community. They should be trained to become efficient members of the family group, regardless of the vocation they may choose. They need training in the selection of commodities which they will consume as members of a modern American community. Finally, the industrial arts teacher has the responsibility of giving occupational information about the trades.



Walter E. Durbahn, chairman, Vocational Education Supervisor, Highland Park, Illinois reveals in "High School Building Trades Projects", this analysis on the organization problem:

One of the problems which confronts school administrators, directors, and instructors of industrial education is the organization and methods of procedure in developing a dual general shop program in the school. Situations are so variable throughout the country that it would be impractical to think of only one method of procedure.

One can only suggest the important factors and certain methods of approach, but it still remains for the individual to adapt them to his own school and community. We must also remember that we have two types of technical information; the classroom variety which aims to relate the mathematics, English, social sciences, drawing, and physical sciences to the trade as well as to broaden the students horizons. The other type of information pertains to the job which is about to be done. It is information necessary to do the work and should be given on the job in connection with the work.<sup>1</sup>

Proposed Organizational Scheme for the Dual System. As was stated before, the dual organization of the general shop with related subjects is interpreted to mean combining within the department, both the general shop and the related courses.

As the case is now, the student must take his related courses from some teacher who is not necessarily well acquainted with the actual application of the subject matter

1. Durbahn, Walter E., "High School Building Trades Projects", Industrial Arts and Vocational Education. March, 1949. pp. 107-111.



taught in his course. In fact, sometimes the teacher isn't even interested in the practical application of his course material, but is more interested in teaching the course for its cultural benefit. It might be stated in reference to mathematics as the "mathematics for the sake of mathematics attitude", rather than "mathematics for the sake of technical application" attitude. Also, in this day and age the broad requirements for a variety of knowledge necessitates the careful selection of material so that it will be of utmost benefit to the student. For instance, there is a definite portion of mathematics that will be most useful to a general shop student, and likewise there will be a certain portion of mathematics that will prove most beneficial to a business administration student. The same reasoning applies to other related courses, such as English, physics, chemistry, drawing, etc.

A splendid example of this type of situation might well be the physics class where the student is taught the behavior of metals in regard to the coefficient of thermal expansion and contraction, whereas a student of welding would derive much more from the discussion were it directly related to the problems involved in the distortion of metals when welded.

It is therefore proposed that within the department of the general shop, there be teachers for all of the related



subjects. These teachers will function solely as teachers for the general shop students, and will be directly responsible to the administrators of the general shop just as a trade or manipulative teacher would be. In the writers' opinion, the ideal situation would involve the use of teachers trained in the general shop activities but exceptionally strong in the related fields.

Advantages. To be successful, dual organization of the general shop must be well organized both as to equipment and instructional procedure. The proposed plan of the writer is believed to offer real advantages if educational value is to be measured in terms of results produced.

Good teaching in any subject makes a similar demand on the ability and preparation of the instructor. From this statement, and as it relates to the dual organization plan as proposed, it is reasonable to assume that an instructor well trained in the shop activities could do a good job of teaching this particular phase. Likewise an instructor well trained in the shop activities, and especially so in the related subjects could do a very good job of teaching the related subjects as they apply to the shop activities. For instance, if a problem was given on finding the number of board feet in some pieces of lumber, a good related subjects teacher could show the direct relationship between this problem and how it could actually be used in the shop. It



should no longer be a matter of surprise that a teacher must be thoroughly trained in order to meet successfully the many duties and responsibilities implied in the conduct of industrial arts courses.

It is an accepted fact that some related information must be given during the actual performance of the shop activities, but in thinking about the time element involved, the dual organization plan would take care of the major portion of this, in that the student would already be familiar with the related fundamentals, and as they apply to the shop activities.

As stated before, it has been brought to the attention of the writer that the general shop has been widely used as a dumping ground for students who seem to be academically slow. Here, it is expected that the shop teacher can do something for the student. It is probable that some success can be realized from such a gesture, but by exposing the student to the plan as proposed in the dual organizational scheme, where the student can be shown the direct relationship between the related subject matter and the job being performed, it is believed that more success can be had in like situations.

It is usually possible to secure closer cooperation within a group if the group is functioning under a common administrative framework. The dual system by virtue of



its characteristics would definitely promote a smoother coordination of the shop and related courses. This coordination would present itself in terms of correlation of subject matter types, the amount of subject matter and also from the standpoint of the time coordination element. By time coordination element, reference is made to correct timing of needed information. In other words, to make use of economic terminology, there will be definite trend toward a stabilized supply and demand curve as would apply to the information market.

It is also the belief of the writer that there are advantages to be had from the standpoint of preparation, both from the type of student to be taught and the type of material to be presented.

In order for a teacher to maintain a high coefficient of information and idea transmission between himself and the student, it is necessary for the teacher to be able to type the student from the standpoint of background, calibre, and reasoning trends. When the teacher is confronted by a group of students whose aims and interests are very diversified, this becomes an increasingly difficult task. But with the teacher directing his efforts toward the general shop exclusively, this condition can be greatly alleviated.

In the opinion of the writer, there is now in existence a number of situations where there is absolutely no communication between the teacher and the student. This is indeed



a serious condition.

Disadvantages. It is an inevitable conclusion that there are inherent disadvantages to be found in any system that is adopted, but the merit of the system is found in the fact that they are overbalanced by advantages.

Some of the disadvantages to be shown here are those which have been found to exist in the conventional general shop, and those that will probably exist under the proposed plan.

One of the disadvantages known to exist in the general shop is presented in the use of individual instruction sheets, which tell how to do a complete job, and can be a highly refined teaching device. On the other hand they present a number of difficulties from the standpoint of modern methods<sup>1</sup> of teaching.

These defects do not apply equally to all types of instruction sheets. While they appear numerous in aggregate, the objectionable features are not permanent, and are rapidly being eliminated in the better types of individual instruction sheets. It is too often true that these sheets:

1. Give special favor to the pupil who reads well.
2. Deprive the pupil of a chance to analyze the job and find out for himself what is to be accomplished.

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1. Newkirk, Louis V., and Stoddard, George D., The General Shop. The Manual Arts Press, Peoria, Illinois. 1929, pp. 50-51.



3. Take away the pupil's opportunity to plan the doing of the job.
4. Decrease the amount of personal contact with the teacher.
5. Are not conducive to thorough demonstration by the teacher.
6. Do not provide the pupil sufficient opportunity to ask questions.
7. Lack related information.
8. Utilize words that are not selected according to research studies of the pupil's vocabulary.

It is reasonable to assume that disadvantages of this same sort would be present in the dual set-up, but the same could be greatly alleviated by some competent help on the part of the related English teacher. Ample time could be given to the careful wording of these instruction sheets, to the extent that the most poorly read students would not be at a great loss in trying to understand them. Also, the information listed thereon could be limited to such an extent that the student would still be challenged, in that, he would still be given a chance to analyze the job and find out what is to be accomplished.

It was noted that the instruction sheets take away the pupil's opportunity to plan the doing of the job. This situation could probably be alleviated too, by the related teacher putting more emphasis on how to do, rather than on



what to do.

It is not a definitely established fact, but under the dual system there might be an expensive increase in instructional staff. It is fairly certain that there would be an increase within the general shop department, but there would of necessity also be a decreased demand on the teachers outside of the general shop. Whether or not there would be a balance is for the future to tell.

Some might consider it a disadvantage to take the general shop student from what might be considered a more cultural environment, but this too might be a controversial issue. It might be the question of specifically absorbing something, or generally absorbing nothing.

### Problems

The Teaching Problem. How the general shop can be taught efficiently under the proposed organizational scheme is a problem that would confront administrators and teachers who might want to adopt the plan. To meet needs which will probably arise in the teaching of a wide range of instructional material a number of teaching devices are proposed. These are not new devices, for they have proven their worth in other fields. These are deserving of careful consideration, since it is through their refinement and proper application that the general shop, as well as the proposed system may reach



high efficiency.

1. Individual instruction
2. Group instruction
3. Class instruction
4. Demonstration
5. Reference materials

Analysis. In generalizing, it may be said that a careful analysis of the objectives of any subject will indicate that behavior changes are really desired.

The student's behavior after he has finished the course should be different from that when he started. If this is not the case, learning has probably not taken place. For example, if aesthetic appreciation is accepted as an aim of industrial arts, then the student who has studied about the various types of textiles will be expected to behave differently when he enters a home which has a beautiful oriental rug on the floor. He looks at the rug in a different way. He may even wish to feel the texture. These reactions indicate that learning has taken place and that behavior changes have been made.

Since behavior changes are the desired outcomes, the objectives should be analyzed in terms of such changes as appear desirable. This is a step which cannot be ignored if concrete and tangible results are desired. Too frequently aims and purposes remain vague and unattainable because



their true significance is not disclosed by a searching study of what is required by way of behavior.

Organizing Course of Study. Wherever work is to be done by more than one person, some degree of organization is necessary. One of the major factors in human progress is the ability to plan, to organize and to make organization function according to plan. This principle is involved in successful class work as in all group activities. An instructor should not consider himself prepared to teach a course in the general shop until he possesses; (1) a scientifically prepared course of study; (2) the necessary teaching aids and management devices; and (3) a shop arranged and equipped for the presentation of the proposed divisions.

The task of preparing a course for the proposed general shop could hardly be a small one. Preparing the course of study and the accompanying individual instruction sheets will tax the teacher's ingenuity and make large demands upon his time. Much good work has been done in the preparation of instructional materials, both by teachers and curriculum specialists, but all of it constitutes only a modest beginning. The future is sure to see the development of much valuable material.

The organization of the proposed type of general shop is a problem that requires planning and good judgement on



the part of the administrators, supervisors, and teachers. In reality, the approach to valid subject matter should be in keeping with what the majority choose or agree upon, in light of what will be most beneficial to the student. The logical curriculum is the piecemeal affair. It adds up the "subjects" until they meet the "requirements". It fits the pieces into a picture of "what should be known". It is true that for practical administration, certain bodies of subject matter must, at times, be injected into the curriculum because they are "necessary" to make some other subject matter intelligible, but when this is necessary, it can always be motivated in terms of real, not imaginary necessity.

Guidance. Guidance is and has been one of the most neglected phases of education with relation to the general shop. Instructors of shop subjects are in a unique position for assisting youth in learning about a large field of occupations. One of the principal objectives for the work in secondary schools is the opportunity to explore mechanical occupations.

With this aim in view, the instructor will at all times see to it that shop practices carried on in industrial arts activities are in good taste and acceptable by industrial concerns. But the instructor's opportunity does not end with the practical work at the bench or at the machine. There is much valuable information about the occupation represented, and about related occupations that will not come



into a student's possession through the limited amount of manipulative work which is possible, in the school. It is the duty of the instructor to analyze such informational material, and to select from it such phases for presentation as will help the student to make a more intelligent, future vocational choice.<sup>1</sup>

There is no good reason why the instructors, when planning the program for the theoretical material, should not also include such phases of that material as may have no other specific purpose than to enlighten students in regard to the characteristics of the trade and its related branches as a possible future vocation for the members of the class. The need for covering the broad field of allied occupations is evident when the fact is considered that one shop activity may represent ten or more distinct trades.<sup>2</sup>

Making The Plan Work. In carrying out any plan it is necessary for the teacher to direct his attention to the things that can be done, rather than to those that probably cannot be done. It is not necessary that the plan be followed in every detail and under all conditions in order to derive a benefit from it. A plan whose mechanism is so

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1. Ericson, E. E., Teaching The Industrial Arts. The Manual Arts Press, Peoria, Illinois. 1946. pp. 178-179.

2. Ibid. pp. 178-179.



intricate that if fails, if some part is modified, is not flexible enough for the complex needs of modern life.<sup>1</sup>

A plan of procedure which brings good results in one trade might not be satisfactory for another, or physical conditions may require a modification of the plan. Flexibility and adaptability are essential.

The number of students that can be satisfactorily instructed in one class will vary in the different trades and will vary with conditions and character of the work in the same trade. In general, however, it will be found that a group of more than ten or twelve is rather large for the most satisfactory work and that a group of less than four or five is rather small. The group must be small enough for the teacher to give aid when needed and to keep the students engaged at all times, and it must be large enough to develop a sort of group spirit and to keep the teacher busy at his proper tasks of giving help where help is needed.

In most shops it would be well to divide the class into small groups with not more than four or five pupils in a group. One of the group should be designated as leader and placed in charge of the job. His duties would be very largely those of a foreman. Such a plan would reduce largely the

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1. Selvidge, R. W., How To Teach A Trade. The Manual Arts Press, Peoria, Illinois. 1923. pp. 96-97.



number of students with whom the teacher must deal directly in handling a job, and at the same time would give an opportunity to develop leadership and self-confidence. The pupils could learn how to receive orders and to work together.

Having a definite and clearly understood plan with complete directions, the student should proceed with speed and decision. Loitering, indecision, or careless and slovenly habits should never be permitted. The teacher should observe the work carefully and render assistance only where it is actually needed. Give enough of the theory of the work to make the students understand the practical side, but not enough to cloud and confuse them.

Administrative Problems. One of the administrative problems to be encountered in connection with the proposed general shop program would be that of maintaining an increased personnel. This would be necessary due to the fact that the related subjects teachers would necessarily have to be brought directly into the general shop department. This would necessitate the allotment of more funds for salaries, and also a change of the conventional program.

Another administrative problem presented by the proposed plan would be the additional difficulty involved in securing properly trained teachers. It has been concluded by the writer that this system would definitely be based on an



adequate and properly trained staff, without which the same could not function as proposed.

There is also the possibility that outsiders, or to be more specific, other teachers of academic courses would have a tendency to make suggestions as to how the related subjects should be taught.

In keeping with the foregoing statement, every shop teacher is both teacher and administrator. His work requires not only skill in selection, organization, and teaching of instructional materials but skill in the management of supplies records, equipment, products, budgets, power, and numerous other factors. In this respect, far more is required of him than of his fellow teachers of "academic" courses. The position of shop teacher is therefore one of unusual responsibility, demanding much out-of-class work and the best efforts of highly-trained, fully-qualified men.



## CHAPTER III

## RELATED THEORY AND ITS FUNCTIONS

The subject matter of the dual organization of general shop is of two types. First, there is the work which is largely manipulative. This includes all the constructive activities carried on with tools and machines. The tangible results are the projects which the student produces or the jobs which he completes. The second type of subject matter is usually designated by such terms as "related", "related technical," or "related subject matter". Included are all the lessons and concomitant learnings which take place in the class and cannot be classified a manipulative. Under this heading may be classified such items as the names of tools and materials, the manufacture of lumber and steel, how to figure board feet, and countless other topics. The problem which immediately confronts the teacher is, "How am I to choose the proper subject matter for my classes?" "How am I to know what projects my students should make, and what lessons should I teach?"

Basis For Selection of Subject Matter. There is one primary purpose of all subject matter. That purpose is to achieve the objectives of the particular course in question. While it is true that outcomes which are beyond and aside from the expressed objectives may be achieved, yet these



are incidental, and the subject matter is not chosen with these extraneous ends in view. Subject matter should be chosen or rejected exclusively on the basis of whether or not it contributes toward the meeting of these specific objectives which the teacher or administrator has in mind for the particular group of students.<sup>1</sup>

The test for judging whether any specific item of subject matter should be included in a given course is, therefore, to ask the question, "Does it contribute significantly toward bringing about one or more of the desired behavior changes?" If the answer is "yes", then that item may well become a part of the subject matter. If, on the other hand, the answer is "no", then - regardless of how interesting or desirable that particular item may be - it should be rejected. This conclusion holds true whether one is considering a new project, a field trip, a motion-picture film, or a discussion topic.

Noted authorities have found this to exist.

Clayton E. Buell in his "Make Related Mathematics Related", says:

The greatest motivation is secured when a topic is taught just when that knowledge is needed. If this principle is to be taken advantage of, the formal arrangements as found in academic books must be broken up.<sup>2</sup>

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1. Wilber, Gordon O., Industrial Arts In General Education. International Textbook Company, Scranton, Pa. 1949. p. 57.

2. Buell, Clayton E., "Make Related Mathematics Related", Industrial Arts and Vocational Education. Volume 38, October 1949, pp. 319-320.



The related teacher and shop teacher can have their program so well correlated, that to achieve this purpose will not disrupt their training program.

It is often said that if the basic mathematical fundamentals are given the student, he will apply these general principles to the trade problems that he will meet on the job. True, the more intelligent students will be able to make some transfer from the abstract to the concrete effort, but the average pupil will not be able to make much, if any, transfer.

Either the related teacher must learn more of the trade to supplement his mathematical knowledge, or the student must be given an education in mathematics that compares in a measure to that of his teacher if he is going to use calculations in his work to any appreciable extent. It is, of course, practical for the teacher to learn enough of the trade to determine where and how mathematics can be useful in the trade, than by having the pupil try to learn a lot of excess mathematics and then to apply a small portion of this half-learned knowledge to his job. The initiative must be taken by the teacher.

In order to find out what mathematics is applicable to a certain phase of learning, and to present it in this situation, the related mathematics teacher must work very closely with the actual shop jobs, blueprints, and with the skilled shop teacher. He must assemble his trade knowledge



from these several sources, sort out the problems where mathematics may be used advantageously, and then organize this information into a psychological teaching sequence.<sup>1</sup>

The related teacher should start with the problems of the trade and go from there to the mathematics needed, and not the reverse. He should list every important job that might be encountered in the trade and analyze it to see what must be understood by a good mechanic or supervisor. Then he must analyze each of these calculations to see where it might fit into the related mathematics course. He must keep in mind that mathematics is just another tool to be used in planning and executing the job in the trade.

Textbooks. Textbooks should be provided for all students in the general shop. The textbooks should include the essential information, tool processes, experiments, and projects which are fundamental to the course being offered. The textbook should be well illustrated, carefully organized, and written so that the students can grasp the meaning quickly.

When general texts are available, one book can be selected for the entire course; when a general text is not available, texts can be selected for each unit. For example, if the general shop is equipped to teach electricity, metal-working, plastics, and drafting and the class size is 25,

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1. Ibid. pp. 319-320.



five copies of each text can be purchased for use in five divisions.

Well written texts should contain the materials that are essential to the unit of instruction which they represent. While at the present time references are desirable for use with texts and individual instruction sheets, there is evidence that, as instructional materials become more refined and better adapted to the courses of study, fewer references will be needed.

There may be some question regarding the addition of the time element in a situation that stresses individual progress. However, it is necessary to pace the related work in order to keep it parallel with the shop work. The time expressed in class sessions therefore presents the importance of the various phases of the course as determined by the shop needs. The work done by each individual still depends upon individual ability.

Considerable thought should be given to functioning material - material needed to understand and to proceed with the hand skills involved in the areas offered in the shop. In order to understand some particular mathematical formulas it may be necessary to be competent in the manipulation of algebraic equations, or a knowledge of simple fractions may be required. If an item of information has been determined by the analysis as necessary for the accomplishment of some hand skill, it is considered to be a functioning material.



If some academic item of information is needed in order to understand the handling of such a functioning item, it may also be considered as necessary for the accomplishment of the hand skill and it is therefore functioning material.<sup>1</sup>

In the presentation of related subject material, especially the related subjects that are similar to such academic fields as mathematics and science, it is essential that the instructor determine first of all the limit of the subject areas, that is, the beginning and ending points of his subject material. These limits will be determined by the analysis and outline of instruction which should show the definite needs of the students, with relation to the shop courses being offered.

It is therefore essential that the related subject instructors realize that properly selecting related subject material is as important as the shopwork and that they supplement each other in the presentation of an effective training program.<sup>2</sup>

The main problem to be solved by the related subjects instructor, as well as the shop instructor is not where to find material to teach but how to select the proper material

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1. Hill, Warren E., and Ewing, C. H., Materials and Methods for Vocational Training. McGraw-Hill Book Company, Inc. New York. 1942, pp. 160-163.

2. Ibid. pp. 160-163.



that can be taught, in the time available, to the student to be taught, and with the available equipment.

Projects. Certainly the task of preparing a course in the proposed general shop is not a small one. Preparing the course of study and the accompanying individual instruction sheets will tax the teachers ingenuity and make large demands upon his time. Much good work has been done in the preparation of instructional materials, both by teachers and curriculum specialists, but all of it constitutes only a modest beginning. Now is the time for projects. The instructor may allow two students each to work on some given project.

The instructor may now spend his time profitably in giving individual help to pupils who need attention in planning their work. As the pupils approach the completion of their first projects, the instructors will have a new duty in the inspection of finished projects and written matter. Each pupil should be graded on the quality of workmanship and on the knowledge that has been gained in connection with the project as evidenced by his answer to questions which are given out with the job sheet.

In addition to reassignment of projects, it will be necessary from time to time to demonstrate new projects so that they may be assigned. These short demonstrations can usually come at the beginning of the period, but they should leave much for the pupil to do "on his own", for it is in



this detailed planning and execution for one of the chief values of industrial arts is realized.

Experiences. In addition to the directly related lessons, however, there is a great body of information which cannot be connected to any given process or project and yet is important in an understanding of our industrial society. This is information given students from direct experiences and knowledge of the teacher. Examples of this type of information are: How iron and steel are manufactured; how lumber is produced and seasoned; how to figure board feet; the composition of modeling clay; the work of the loom-tender; collective bargaining in industry; safety standards; what to look for in buying furniture; what indicates "good" design in an automobile; the meaning of "lift" in an airplane. It is evident that such topics are vitally important from the standpoint of achieving the objectives of industrial arts. How and when they should be taught, however, is a major problem which the shop teacher must face and answer.<sup>1</sup>

Clearly it is psychologically unsound to simply select lessons at random from a list of topics and to teach such lessons as isolated items of information, unrelated to anything that has been taught before or that will follow. To do this would be equivalent to teaching various historical

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1. Buell, Clayton E., op. cit. pp. 93-94.



facts without any relationship to their chronological sequence. Evidently, it would be almost impossible to remember facts so taught or to organize them into any reasonable pattern. There is a need for a central care or theme around which all such information can be related.

Visual Aids. A visual aid, as the term is used in connection with education, may be defined as any type of visual stimulus used to supplement instruction by the spoken or printed word. Modern education requires the extensive use of an unending variety of audio-visual materials such as motion picture films, filmstrips, slides, speech and radio and television programs, maps, charts, graphs, periodicals, pamphlets, photographs, drawings, paintings, models and other non-book aids in the educational process.

Each type of aid makes its own unique contribution to the vividness presentation, motivation of learning, creation of desirable behavior, and increase of retention. This is particularly true of projected visual aids such as the film with its appeal to both the audio and visual senses. The degree to which these aids contribute to the educational process depends on the effective selection and utilization of the materials.

For the utmost convenience and effective use, all rooms of instruction would have to be equipped permanently with all aids. However, this would be exceedingly expensive, as



well as poor planning since many items are used only a portion of the time. Suitably located storage closets and preview rooms which serve several rooms provide more efficient utilization of costly equipment.<sup>1</sup>

Industry and industrial civilization must be made real and vital to youth. Words alone cannot accomplish this. Every device at the teacher's command must be used to explain and make clear just what is meant by industry -- its raw materials, workers, processes, organization, and finished products. The student also needs help in bridging the gap between the processes as they are performed in the school shop and industrial methods used in production industries. To present this picture, many types of visual materials must be used.

Another function of visual aids, which may not have a direct effect on instruction but which certainly has an important indirect effect, is their use to create atmosphere. It is possible to transform the most bare and unattractive room into a stimulating environment by the use of color and such visual aids as pictures, charts, displays, and murals. Devices of this type tend to produce an atmosphere of work, study, and experimentation. There is some evidence which seems to indicate a close correlation between the atmosphere

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1. American School and University. American Publishing Corporation, New York, N. Y. Vol. 21, pp. 261-262.



of the school shop and the types of learning which takes place there.

Industrial Trips. The industrial excursion is one of the most valuable forms of visual aids. It is especially effective because of its reality. Here the student sees not a picture or graphic representation of industry but the real thing. This type trip, properly planned and carried through, represents the ultimate in effectiveness for exploration and orientation. Its value will depend, however, on how well the class is prepared and the extent to which experiences and impressions are discussed and checked after the trip is completed.

Trips should never be taken on the "spur of the moment". They should be carefully planned, and the class should be prepared for what it is to see. If possible, the instructor should visit the plant and determine what the students are likely to see.

The most important part of an industrial trip is the discussion and checking which follows. If the class is divided into groups with special assignments, each group should make its report to class.

Demonstrations. Demonstrations as partially discussed earlier, ranks with the industrial trip in the matter of realism, since real tools, materials, and actual operations are presented for student instruction. Since the major value of the demonstration depends on its presentation through the



visual sense, every possible effort should be made to make certain that all students see exactly what is being demonstrated. This requires careful spacing of students and also such skillful demonstrating that the important movements and operations are clearly evident to each student in the group.

Moving Pictures. Next to the demonstration in terms of reality, and certainly in terms of interest, is the motion picture. It is especially valuable in bringing to the classroom certain aspects of industry which cannot readily be seen at first hand. For example, it would be impossible for most classes to visit a lumber camp to see how trees are made into lumber. Even if such a trip were possible, it is doubtful if all of the various aspects of lumbering could be seen in a limited time. A movie, however, can bring the complete story in a vivid, interesting manner to the group at the time when this particular information is most needed.

The movie is also useful in the teaching of certain skills. In some ways it is better than the demonstration in that everyone in the room can have the best possible view of the process, and the most skillful demonstrator can be brought to the group. In the hands of skillful teachers the use of films for teaching basic skills is sure to increase rapidly.

Mock-Ups. The use of mock-ups as an aid to instruction has been greatly accelerated by their extensive adoption by the armed services. Significant gains in time required for



understanding such complex units as airplane carburetors, fuel systems, radar hook-ups, etc. were made by displaying these in simplified form on a suitable mounting. Functions of various parts and relationships of one part of another<sup>1</sup> are made easily understandable by a well planned mock-up.

The preparation of a mock-up is not a project that can be accomplished in a moment. First it must be carefully planned and then skillfully constructed. Once complete, however, it can be used over and over. It is frequently possible and desirable to use student help in building mock-ups. Certainly the students who work on them develop a depth of understanding of the principles and problems involved which it would be difficult to obtain by any other method.

Charts, pictures, graphs, maps, etc. A wealth of visual materials in the form of pictures, charts, maps, graphs, etc. is available to all teachers. Industrial and commercial firms compete with each other in trying to produce the most striking and arresting graphic materials.

Every shop teacher should have a constantly growing collection of graphic materials that can be used as the occasion demands in connection, with specific lessons or to create atmosphere for the shop. Effective use of display materials can transform even an ugly room into a cheerful and challenging laboratory.

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1. Wilber, Gordon O. op. cit. pp. 134-136.



Film Strips. The use of the film strips as an aid to instruction is of relatively recent origin. Certain features of both the motion picture and the slide are combined by printing a number of related pictures (together with informational notes) on a strip of film. These pictures are then projected on a screen in much the same manner as are ordinary slides. A special device on the projector makes it possible to advance the strip so as to show the pictures successively.

The film strip has the following advantages over both the movie and the still slide from an educational standpoint:

1. The pictures are in a certain predetermined order and cannot become mixed or out of sequence.
2. Once the film strip is correctly inserted in the projector, there is no chance of having the pictures appear inverted or reversed on the screen.
3. Certain parts of the strip may be used and other parts omitted.

Slides. Glass slides have been used for many years as an aid to instruction. Slides are of two types - the glass slide and the transparency. The glass slide is usually  $3\frac{1}{4}$ " x 4" and is made by printing a photographic negative directly upon a sensitized glass plate, which is then developed photographically and protected with a cover plate.



As a teaching device, slides are especially useful in illustrating designs, in depicting single processes, and in illustrating related lessons.

Reflectoscope. The reflectoscope is another device which is much used as an aid to instruction. As the name implies, it is designed to reflect pictures, drawings, blueprints, or even actual objects so that they may be viewed on a screen. Basically, it is simply a means of reflecting light from any desired drawing or object, focusing it through a series of lenses, and projecting the resulting image on the screen.

The reflectoscope is especially useful in supplementing lectures or class discussions because such a large variety of materials may be used.

Project Charts. The project chart is a type of visual aid which is particularly adapted to industrial arts. It usually consists of a project in various stages of development. Charts may be developed covering a wide range of processes and projects. Their major value lies in helping beginning students to learn project planning.

The general shop teacher should use visual aids for two purposes. First, instruction - both for the development of skills and for giving information - should be enriched by a well selected series of visual helps. Secondly, the atmosphere of the shop should be enriched, and made attractive



by the judicious use of pictures, charts, mock-ups, and models. Even the most perfect lesson can be greatly improved by the addition of visual materials.



## CONCLUSION

In conclusion, the writer feels that the virtues of the dual system have been exposed, and that it is here proper to make a slight reiteration.

It has been shown that by adopting this system, we are in effect establishing within the industrial arts department the teaching of related courses. In doing this there will have been promoted a more smoothly coordinated system, from the standpoint of both personnel and subject matter.

Stress has definitely been placed on communication between the teacher and the student. As a result it is believed that the general shop will have produced a better qualified student, by exposing him to the dual system. It is often said that "the end justifies the means." If this is true, it can safely be said that the dual organization of the general shop is a justifiable means of improving the quality of instruction and subsequently the quality of the student who will emerge as a product of the general shop curriculum.

On the following pages will be found exact copies of letters from department heads of various colleges in the field of industrial education relative to dual organization of the general shop with related subjects and their reactions to such a proposal.



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AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

College Station, Texas

August 13, 1952

Department of  
Industrial Education  
Industrial Arts Education  
Industrial Vocational Education  
Industrial Technology

Mr. Luther V. Francis  
P. O. Box 2115  
Prairie View A & M College  
Prairie View, Texas

Dear Mr. Francis:

In response to your letter of August 7, we consider "Dual Organization of the General Shop with Related Subjects" a very worth-while subject for a problem in Industrial Arts. Your proposal that related subjects and general shop activities be combined certainly entertains our approval. We know your research will do much to prove this thesis and will contribute much to the field of Industrial Arts.

Yours very truly,

Ralph J. Vernon  
Acting Head

RJV:jl/dal



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THE PENNSYLVANIA STATE COLLEGE

School of Education

State College, Pennsylvania

Department of Industrial Education

August 12, 1952

Mr. Luther V. Francis  
P. O. Box 2115  
Prairie View A & M College  
Prairie View, Texas

Dear Mr. Francis:

This is in response to your letter of August 8 in which you ask about the certification requirements for related subjects teachers and shop teachers.

To answer your questions specifically, I do not believe that certification requirements for related subjects teachers and shop teachers should be the same. By separate mail there is going forward to you a copy of our mimeographed bulletin, "Industrial Education as a Life Career", which contains beginning on page 7 the certification requirements for shop teachers and at the bottom of page 8 the certification requirements for related subjects teachers.

Sincerely yours,

S. Lewis Land, Head  
Department of Industrial  
Education

SLL:rek/dal



COPY

KANSAS STATE TEACHERS COLLEGE

Pittsburg, Kansas

Mr. Luther V. Francis  
P. O. Box 2115  
Prairie View A & M College  
Prairie View, Texas

Dear Mr. Francis:

My answer is "Yes". In fact, the related subjects teachers should have a broader academic background than the shop teacher.

Yours truly,

O. A. Hankammer  
Industrial Arts  
Department

/dal



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