AN ANALYSIS OF GENERAL SAFETY EDUCATION FOR INDUSTRY AND VOCATIONAL SCHOOLS WITH SPECIFIC RECOMMENDATIONS FOR WOOD SHOPS AND MACHINE SHOPS

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AN ANALYSIS OF GENERAL SAFETY EDUCATION FOR INDUSTRY
AND VOCATIONAL SCHOOLS WITH SPECIFIC RECOMMENDATIONS
FOR WOOD SHOPS AND MACHINE SHOPS

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CHAPTER I

INTRODUCTION

Purpose

Since the dawning of the industrial era, the problem of safety has constituted one of the major considerations of industry in all of its varied phases. The necessity of keeping thousands of men and women in constant proximity to moving parts of machines has created the real difficulty of assuring their safety from injury.

Now that public secondary schools have established various types of shops and laboratories for the preparation of students who soon will be faced with the privilege of earning their livelihood in the trades and vocations of the present age, the problem of safety is as real in the school shops as it is in factories and industrial shops. The pupil in the school shop who works with saws that are powered with electricity, or who operates power lathes, drill presses, or even hand tools, must exercise caution if he is to do his work without injury to himself or damage to the machines.
The purposes of this study are to survey the growth of safety concepts in industry and in school shops, to point out the fundamental factors involved in a functioning and worthwhile program of safety education in secondary schools, and to indicate safe practices to be followed by operators of machines in wood and metal shops in secondary schools in order to minimize to the utmost the possibility of accident in such shops, and to set forth a recommended procedure embodying a program of safety for wood and metal shops in secondary schools. This safety program has been employed by the writer in his classes in industrial arts, and it has been modified from time to time for the purpose of enhancing its workability and its practical value in attaining the desired end, namely, the vocational training of youth with a maximum of efficiency and a minimum of hazards.

Source of Data

The data utilized in this study were obtained from books written by authorities in the fields of industrial and school-shop safety or compiled by the research staffs of committees or organizations interested primarily in the problem of safety; from published and mimeographed bulletins and pamphlets issued by the federal government, by state governments, or by safety and industrial organizations; from magazine articles written by recognized authorities; from the research materials of the National Safety Council, the
outstanding safety organization in the United States; and from the writer's observations and experiences in teaching industrial arts and safety, together with a broad academic preparation in the field, including study at various educational institutions under the tutelage of recognized authorities. All photographs appearing in this study are taken from the revised edition of *Shop Safety Illustrated*, a 1940 publication of the National Safety Council.

Organization

The present chapter consists of a statement of the purposes of the study, the sources of the data, and the organization of the report.

Chapter II deals with the psychology and philosophy of safety, including the concepts of safety education, methods of teaching safety, and accidents and their prevention.

Chapter III is a phase of the study designed to determine the educational contributions of industry to a school-shop safety program. Safety factors and practices in the use of hand tools and in the operation of machines for wood and metal shops are treated in a comprehensive manner. Suggestions for the establishment of a definite program of safety for school shops are offered, and applicable first-aid practices are mentioned.

Chapter IV is concerned with the setting up of a program of safety for wood and metal shops in secondary schools,
and consists, in the main, of a recommended procedure embodying a workable series of practices in safety and the prevention of accidents.
CHAPTER II

PSYCHOLOGY AND PHILOSOPHY OF SAFETY

Introduction

The business of living has always been an adventure, but it is more of an adventure today than ever before. Some of the old dangers and threats to man's safety and happiness have disappeared with the passage of time, but in their places have arisen others more numerous and more serious. The machine has assumed a position of major importance in the life of everyone. Every person comes in daily contact with innumerable mechanical devices in the home, on the street, in the place of employment -- all of which, a short time ago, were unknown and unanticipated. These hazards are so great, the techniques of meeting them are so complicated, and the intellectual and emotional preparation needed for living satisfactorily and safely among them is so extensive that the problem of safety has emerged as one of the major considerations of twentieth-century civilization. The home is unable to meet the problem alone. The community and the school must each assume a share of the responsibility, and the school must give added attention to safety as one of
the vital activities and concepts that assist children in living more effectively. "It is to the school particularly that we must look for the development of the knowledge, the attitudes, the habits, and the skills that are necessary if we are to live with reasonable safety in the modern world."\(^1\)

Recently, safety has come to be regarded as one of the most important problems in industry, in the home, in the school, and on the street and highway. Not only from the standpoint of the preservation of human life is the problem a vital one, but also from that of financial loss through destroyed materials or damaged property, and through curtailment or complete loss of earning ability.\(^2\)

On August 18, 1941, President Roosevelt issued the following proclamation in which he emphasized the need for additional stress upon safety during the present era:

The nation is confronted with a rapidly rising accident toll. At the present rate, the total number of deaths from accidents this year will exceed 100,000. Traffic accidents alone caused 34,500 deaths in 1940, and thus far in the present year there has been an increase of seventeen per cent in traffic fatalities. By taking a huge toll in life and property, accidents definitely hinder our national defense effort. To insure maximum efficiency we must have maximum safety twenty-four hours a day -- not only at work, but also on the highway, at home, everywhere. The troubled times in which we live must not make us callous or indifferent to human suffering. These unusual times require unusual safety efforts.

\(^1\)American Association of School Administrators, Safety Education, Eighteenth Yearbook, p. 9.

\(^2\)Vernon G. Schaefer, Safety Supervision, p. 1.
Now, therefore, I, Franklin D. Roosevelt, President of the United States of America, do hereby call upon the officers and directors of the National Safety Council to mobilize its nation-wide resources in leading a concerted and intensified campaign against accidents, and do call upon every citizen, in public or private capacity, to enlist in this campaign and do his part in preventing wastage of human and material resources of the Nation through accidents. . . .

Measures designed for the control of accidents should be directed toward such physical or mental conditions as fatigue, worry, unrest, attitude, coordination of muscular and mental faculties, mental and physical reactions, sense of responsibility, motives, humanitarian impulses, and other related factors that influence the action -- or the inaction -- that may lead to accidents. The psychological implications involved in the above-mentioned factors are at once apparent. The psychology of safety can be briefly defined as the creation of interest in safety and in safety practices through the application of known interests and incentives possessed by the worker or the learner.

Concepts of safety must be carefully built up and brought to bear upon the consciousness of the pupil in the school or of the worker in the industrial plant. Particular skill must be exercised by the industrial-arts teacher in developing these concepts with his pupils, since adolescent pupils are especially prone to do things in the most

4 H. W. Heinrich, Industrial Accident Prevention, p. 268.
5 Ibid., p. 73.
rapid way possible with little or no consideration for their own safety or for the welfare of their co-workers. They are characteristically impatient, and are likely to be impulsive in their undertakings and indifferent to anything which has a tendency to reduce their speed of accomplishment. To some adolescent pupils, safety devices and practices are an unnecessary hindrance; and the instructor must be able to meet the arguments of youth and to demonstrate the practical utility of "safety first." Once the youth has seen for himself why safety is worthwhile, he will be a convert to its practical applications.

All of us admire and respect courage. Adventure too has a universal appeal. The childish notion that a devil-may-care attitude is an essential part of courage and that the adventurous are always gay, carefree individuals is gradually outgrown during the high school period as the student increases his ability to face the realities of life and to think his way through them. During this time he becomes aware that the really worthwhile adventures of life are planned with care and foresight, and prepared for to the very last detail. No emergency that the human mind can anticipate is left to the uncertainties of chance. He becomes aware too that even for ordinary, everyday performances thought and care are necessary if accidents are to be avoided.

To think clearly and to perform skillfully, no matter what the activity or the task, constitute a far greater and more real challenge to American youth than does a role of aimless daring and ostentation. The world of youth grows more complex and difficult. Life's interesting adventures now require more care and preparation, better thinking, and more skills than ever before.6

6Francis L. Bacon, Outwitting the Hazards, preface, p. iii.
Education for Safety

In the present age there is little necessity for pointing out the fact that safety education is of vital concern to everyone. Accidents and mishaps are to be encountered in all of the activities in which men and women engage in the complex world of the present day. In assisting man to protect himself against accident in his home, on the street or highway, and in his place of employment, safety education is rendering a significant contribution to the social, economic, and humanitarian aspects of life.7

Since "one of the prime purposes of the school is to enable the oncoming generation to adjust itself to the natural and social environments in which its members must live and work,"8 it is only logical that the school should be the place where education for safety has its origin. The more the educational system can do toward preventing accidents, the greater will be its contribution to the total happiness and the general welfare of man. The school often is handicapped in its safety efforts by the fallacious opinion, held by many, that emphasis upon safety is negative in nature, that it takes something out of life. Among adolescent

7 Department of Public Instruction (Pennsylvania), Safety Education in Industrial School Shops, p. 4.

youth, this concept is widespread, and only as it is dispelled will a program of safety in the secondary schools become highly effective.⁹

It is often maintained that the encouragement of a safety habit of mind is likely to lead to faint-heartedness, cowardice, and over-anxiety, and to dull the spirits of adventure. It must be admitted that this argument cannot be ignored, and the answer is that care must be taken to develop the safety habit on the right lines. It is usually possible to distinguish between legitimate risks and those which are mere foolhardiness, and we ought to be capable of instructing young people in such a way that they are able to decide for themselves to which class a given activity or accident risk belongs. It is true that their decision will often be unduly influenced by the spirit of bravado which is inherent in most children and especially in boys, but even this will react to some extent to sympathetic and persistent instruction.¹⁰

In any program of safety, it is necessary to pay considerable attention to what have been called "the three E's of safety": education, engineering, and enforcement.¹¹ Education implies the fulfillment of the pressing need for information and training in safety practices. The majority of industrial workers wish to do their work in a safe manner, people desire to carry on home life without accident, and motorists are eager to drive on the streets and highways without injury to themselves or others. All these groups contain vast majorities of people who want to go about their business in a safe manner, but they cannot know how to do it

⁹ American Assoc. of School Administrators, op. cit., p. 103.
¹⁰ H. W. Vernon, Accidents and Their Prevention, pp. 325-326.
until fundamental safety principles are brought to their attention and safety habits are developed.

Engineering for safety means the elimination of physical hazards and points of danger; in short, it signifies making machines and objects as safe as is mechanically possible, and making highways as nearly accident-proof as they can be made.

Enforcement implies the strict administration of traffic laws, aimed to protect the careful, safe, and conscientious driver and to punish the careless and criminal driver. Enforcement means, also, the formulation of rules and practices for industry in industry, and the unswerving administrative demand that these rules be recognized and kept in operation at all times.

Of "the three E's of safety," the first, education, has been most neglected. The engineering and enforcement phases of safety are fairly well recognized at the present time; but until greater emphasis is laid upon education for safety in all of the activities of life, the desired results in safety and accident prevention are impossible of attainment. Education for safety is primarily the responsibility of the school. Let the school awaken to its challenge and put forth a greater effort for the protection of lives and property from injury and destruction.

In the broad sense of the term, safety is a part of the wholeness of life, for it touches every angle of human
experience. In the narrow sense of the term, safety is wholeness of physical life, implying the avoidance of accidents. Safety education is the art of cultivating those knowledges, skills, and attitudes that make for safety.

Accidents are the result of a cause; they do not just happen. Man himself, as he makes choices, may become a cause of accident; but, to a degree, he can control external causes and situations. The philosophy of pessimism holds that the world is evil and that nothing can be done about it; hence pessimism is not satisfactory as a philosophy of safety, for safety implies that the accidental evils of life can be prevented. Through safety life at its best is preserved. The highest values of life are personal in character, whereas lesser values are material in character; but safety preserves both types of values -- both the person and the property.

There is an ethical aspect of safety. The individual owes it to himself to maintain his capacity at its highest level; he owes it to those dependent on him to keep himself going as well as he can; and he owes it to all persons to be considerate of their life, limb, and possessions. . . .

Safety education aims to make the physical survival of the person possible. As such it is a means to all the good ends of life. Its great contribution is in delivering the person whole so that the other agencies of the good life may make the personality wholesome. Safety education is not an end in itself; it is a means to all good ends. It takes you where you are going so that you arrive; it protects you while you are there; and then it brings you back so you may go again. We believe in safety because we believe in life.
The motives leading to safety are many. We may desire to avoid pain, or inconvenience, or material loss, or giving others trouble, or being thought un-skilful. Or we may desire to make and maintain a good record, or to protect life, especially the lives of children. Perhaps the truest of all safety motives is simple respect for personality, one's own and that of others.

To some, life is too monotonous; they seek to make it less so by taking risks in betting, gambling, and the like. To others, life is too hazardous; they seek to make it less so by reducing risks, as in the various forms of insurance. Safety education is like insurance: It reduces the risk of living and the perils of the risks that must be taken. It does not keep us out of the danger zone, but it makes all danger less dangerous. By protecting the person, it makes possible the enrichment of personality. It is the latest child born into the family of Education, and one of its most promising.12

The safety problem in school as well as in all other places is first of all a personal problem, one for the individual to recognize and cope with: "It begins and ends with you!"13 Safety education is related not only to desirable outcomes and to a type of behavior that is, within itself, valuable and commendable, but it also provides a discipline in attitudes which may be assumed to possess carry-over values that will make themselves known in action. "It places emphasis on consideration for others, on cooperative endeavor, and on positive usefulness for community living."14

12 Herman H. Horne, "A Philosophy of Safety and Safety Education," Safety Education Digest, a publication of New York University, 1940, pp. 3-4.

13 Bacon, op. cit., p. 58.

14 American Association of School Administrators, op. cit., p. 46.
Safety, to a considerable degree, is a manner of thinking. A habit of safety may be developed through experience, through instruction, through the use of caution, and through the employment of various other devices and plans. But, when all is said and done, the effectiveness of any device or method of instruction in teaching people to be careful is to be found largely in the extent to which the device helps to build up a personal point of view on how to go about any hazardous task in the best and least dangerous manner.\textsuperscript{15}

For the accomplishment of this purpose, the following general objectives for safety education are suggested:

(1) To prevent accidents and save lives (a) by developing attitudes necessary thereto; (b) by imparting helpful knowledge; and (c) by developing habits and skills which help in safeguarding oneself and others.

(2) To fuse these elements into a discipline important in itself as a means to effective citizenship.\textsuperscript{16}

In the attainment of these general objectives for safety education, the following specific objectives should be kept in mind as means to the end:

(1) To teach pupils to take an active interest in the protection of the life, health, and property of the community in which they live.

(2) To bring about an appreciation of the responsibility of the individual for the safety of the group and the effect of individual conduct on the safety of others.

\textsuperscript{15}Noel B. Grinstead, "Building a Safety Concept," Industrial Arts and Vocational Education, XXVI (January, 1937), 12.

\textsuperscript{16}American Association of School Administrators, op. cit., p. 47.
(3) To develop cooperation in the solution of such safety problems as traffic hazards, safe driving, and fire prevention.
(4) To create a respect for, and an understanding of, safety rules, regulations, laws, and practices.
(5) To understand the common causes of accidents and how accidents may be prevented.
(6) To develop knowledges and skills applicable to all traffic situations involving pedestrian responsibilities, bicycle riding, and automobile riding and driving.
(7) To develop appreciations of occupational hazards and skills in minimizing these hazards.
(8) To develop knowledges and skills which may be applied to such emergency health problems as wounds, suffocation, poisoning, fractures, dislocations, and burns.¹⁷

Needless to say, the problem of safety education and safety practices is essentially one of conserving human resources. It is vitally concerned with ways and means of preserving America’s most valuable heritage -- the health and welfare of all the people in all of their pursuits and undertakings.¹⁸ Since education for safety must be directed toward people, it is only logical and proper that some consideration be given to the human elements involved in the teaching and learning of safe practices. After much research, two authorities in the field have compiled the following list of the most common human factors that hinder or minimize efforts at education for safety:

1. Worker loafing on the job openly.
2. Invents ways to loaf secretly.
3. Chronically late.

¹⁷Ibid., p. 104.
¹⁸Department of Public Instruction (Pennsylvania), op. cit., p. 4.
4. Quits before quitting time.
5.Absent too frequently.
6. Careless in his work.
7. Reckless regarding dangers.
8. Does not get along with fellow workers.
10. Does not check and correct his own work.
11. Work falling off in quantity.
12. Work falling off in quality.
13. Does not use correct habits of form or technique in performing his work.
14. Won't take criticism.
15. Conduct off the job interferes with his work.
17. Interferes with the work of others.
18. Works by "fits and starts."
19. Ignores health precautions.
20. No desire to learn or to improve his work.
21. Thinks he knows it all.
22. Destroys equipment or materials.
23. Dishonest in some one or more ways.
24. Does not report injury or infection promptly.\footnote{C. A. Prosser and Philip S. Van Wyck, \textit{How to Train Shop Workers}, p. 119.}

The modern school has become a veritable community within itself. In the days when education was disseminated by means of the little red schoolhouse at the country crossroads, the problem of safety was non-existent except in so far as it might be applied to the recreational activities of the pupils. Certainly the school plant itself, consisting usually of one or two bare rooms with no mechanical equipment whatsoever, presented no hazards. At the same time, life outside the school was simple and uncomplicated, and presented few demands for safety instruction. Today, however, the school itself cries out from every corner the need for the exercise of caution and alertness. Hundreds
and thousands of pupils are assembled in one building or in
inter-related buildings, and are preoccupied in doing the
tasks that adults perform in the outside world. The indus-
trial and vocational departments of many modern secondary
schools are fully as complex as factories and plants where
products are prepared for commercial consumption. Inex-
perienced pupils working with strange and dangerous machines
constitute an ever-present need for guidance in safe prac-
tices. They must become acquainted with the hazards of
every machine before they are permitted to operate it, and
even then their operation should be only under expert guid-
ance and supervision, with every possible precaution having
been taken to assure safety at the job. From the industrial
and vocational departments of secondary schools, pupils will
step forth to assume responsibilities in the trades and in-
dustries; and if they do not go into industry with a work-
ing knowledge of safety practices and with a thorough founda-
tion in the art of accident prevention, they are likely to
become liabilities in industry rather than assets. It is
the school's responsibility today not only to send young
people out into the world prepared to carry on the work of
our modern civilization, but in addition they must be pre-
pared to carry it on safely, with an absolute minimum of
accident and loss.

So imperative is the belief that safety education is a
part of the work of the schools that a number of state
where legislatures have made it a mandatory part of the curriculum. Such legislation has a tendency to be too specific regarding methods, materials, and time requirements; but it does offer much valuable guidance in safety instruction, and authorizes school administrators to proceed in developing well-rounded programs of safety education for all ages of pupils.\textsuperscript{20}

Instruction in safety should begin in the home almost as soon as the child can walk and talk, and it should be emphasized throughout his school experiences. Results are almost invariably encouraging when the school sets about to give pupils systematic, practical, and meaningful instruction in safety methods and practices.\textsuperscript{21}

In school, any program of safety or accident prevention, if it is to attain maximum success, must be considered and conducted as an integral part of the teaching program.\textsuperscript{22} As a rule, a separate course in safety education is not considered advisable. Safety is something not to be thought of as apart from subject matter and shop projects, but as an actual part of each job performance. The fundamental laws of learning, involving activities of stimulus

\textsuperscript{20}-American Association of School Administrators, op. cit., p. 45.

\textsuperscript{21}-Vernon, op. cit., p. 326.

\textsuperscript{22}-Training for Safety, Bulletin 279 of the Michigan State Board of Control for Vocational Education, p. 7.
and response, can and should be applied to the development of safe practices. But, if the school's safety program is to be highly effective, mechanical safeguards must be utilized to the maximum extent, and such protective accessories as goggles and first-aid equipment must be supplied in adequate quantities.\textsuperscript{23} The whole school must be interested in safety, and every teacher must accept the challenge to help in the total safety program of the school. Safety cannot be isolated by courses, teachers, or classrooms: it must be a motivating force throughout the entire educational system.

A survey conducted among 14,500 American teachers by the National Education Association disclosed that forty-three per cent of these teachers favored the teaching of safety as a distinct unit in other subject-matter fields, whereas twenty-eight per cent believed that safety education should be set up as separate courses in elementary and secondary schools. Only a very small percentage of these teachers favored only an "incidental" or an "occasional" emphasis upon safety education.\textsuperscript{24}

The data in Table 1 indicate opportunities for the teaching of safety through subject-matter integration. Seven possible fields for the teaching of safety are indicated, and each is rated on whether it presents the best


\textsuperscript{24}American Association of School Administrators, \textit{op. cit.}, p. 61.
### TABLE 1

**OPPORTUNITIES FOR TEACHING SAFETY THROUGH INTEGRATION**

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<th>Fields for the Teaching of Safety</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>School Activities</td>
</tr>
<tr>
<td>Street and highway accidents...</td>
<td>**</td>
</tr>
<tr>
<td>Water safety........</td>
<td>*</td>
</tr>
<tr>
<td>Railroads...........</td>
<td>**</td>
</tr>
<tr>
<td>Water transportation....</td>
<td>**</td>
</tr>
<tr>
<td>Home accidents.......</td>
<td>*</td>
</tr>
<tr>
<td>Electricity and electrical appliances........</td>
<td></td>
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<tr>
<td>Gas and gas appliances........</td>
<td>*</td>
</tr>
<tr>
<td>Burns..................</td>
<td>*</td>
</tr>
<tr>
<td>Falls in the home.</td>
<td></td>
</tr>
<tr>
<td>Use of inflammables........</td>
<td></td>
</tr>
<tr>
<td>School accidents........</td>
<td>*</td>
</tr>
<tr>
<td>Fire prevention........</td>
<td>*</td>
</tr>
<tr>
<td>Safe use of laboratories........</td>
<td>*</td>
</tr>
<tr>
<td>Safety in aviation</td>
<td>*</td>
</tr>
<tr>
<td>Safety in industry</td>
<td></td>
</tr>
<tr>
<td>Forest conservation........</td>
<td></td>
</tr>
<tr>
<td>First aid.............</td>
<td>*</td>
</tr>
<tr>
<td>Medicines..............</td>
<td></td>
</tr>
<tr>
<td>Physical and emotional condition</td>
<td></td>
</tr>
</tbody>
</table>

*A Adapted from Kenneth N. Beadle, *What Should Be Included in a High-school Safety Program?* p. 5. (A similar study is compiled by the National Bureau of Casualty and Surety Underwriters in their publication, *A Guide-book for Safety Education*, p. 4.)

*** Indicates best opportunity for safety instruction.
** Indicates good opportunity for safety instruction.
* Indicates some opportunity for safety instruction.
opportunity, a good opportunity, or some opportunity for safety instruction. It will be noted in the table that the industrial shop, according to this survey, presents the best opportunity for teaching those types of safety pertinent to safety in industry and to safety in connection with electricity and electrical appliances. Homemaking offers the best opportunity for teaching safety in connection with home accidents (including electricity and electrical appliances in the home), gas and gas appliances, burns, falls in the home, and the use of inflammables. Water safety, school accidents, first aid, medicines, and physical and emotional condition, as they relate to safety practices, can best be dealt with in classes in health. Science courses present the best opportunity for safety instruction in street and highway accidents, railroads, water transportation, fire prevention, safe use of laboratories, and safety in aviation. The social studies offer the best opportunity for the teaching of forest conservation. Of the seven fields of instruction mentioned in the table, school activities and agriculture present the fewest opportunities for instruction in safety practices and accident prevention.

Despite the fact that American educators are not at all satisfied with the progress that schools are making in safety instruction, an English authority states that the American child is much better instructed in safety than the British
child. In discussing this point, he comments as follows:

It is generally agreed that there is only one explanation -- the effectiveness of the safety education in American schools. It begins with the teachers, some of whom receive instruction courses from police officers, while unemployed teachers are being trained in safety education and are then drafted for service in the schools and playgrounds. The children write safety essays, and make graphs to represent local accident conditions. They trace the influence of geographical conditions on local traffic problems, and study the dangers peculiar to various forms of transportation. Outside the school curriculum they form clubs known as Safety Councils, where they have talks, lectures, and motion pictures dealing with safety. They choose suitable posters for the bulletin boards, keep accident data relating to the children in their school, and forward them to the National Safety Council. Another activity is the school patrol or brigade, which assists younger children at street crossings, by standing on the kerb and giving "stop" and "go" signals to the children.25

All students should be aided in the development of a safety consciousness which will protect them against accidents throughout their lives. Also, they should be prepared to assume leadership in safety emphasis when they enter industrial employment.26 To establish habits and skills in safety, every pupil must be required to practice correct procedures from the beginning. Under careful supervision, he must practice and drill without deviation from the correct performance. He must be required to practice under guidance until the correct method has been so firmly established that it is automatic or semi-automatic. When this

has been done, he knows only one way of doing the job -- the
correct and safe way.\textsuperscript{27}

It is probably true that any kind of learning is en-
tirely personal in nature; but it is also quite frequently
true that the direction of learning and the material learned
is determined to a great degree by the instructor who sets
the scene in which learning takes place. In the teaching of
safety, as in any other subject, the instructor or the super-
visor bears the responsibility of so setting the scene and
establishing the conditions that the individual pupil may
learn correct and safe habits of thinking and acting. If
safety is to be taught, the teaching of safety must take
place in an environment that is conducive to the learning
of safe practices.\textsuperscript{28}

What appears to be most needed today is a definite safe-
ty program emphasizing habits, knowledges, skills, and atti-
tudes in specific activities that are related to the needs
and interests of each individual pupil. To intensify such
training, and to make it as individual as possible, is the
immediate challenge facing the progressive educator. One
of the significant reasons for education in safety is to
keep the child sound enough in body to attend school and
receive the advantages of education. The fact that safety

\textsuperscript{27}Training for Safety, Bulletin 279 of the Michigan
State Board of Control for Vocational Education, p. 8.

\textsuperscript{28}Schaefer, \textit{op. cit.}, p. 165.
education stresses the observance of law and order and encourages the conservation of life and of natural and mechanical resources, constitutes a powerful reason for making safety instruction a vital part of the school program. The question often arises as to whether pupils are interested in safety. Personal experiences of educators through long years of work with adolescent youth indicate that boys and girls are eager to learn skillful and efficient (which means safe) ways of doing all the things in which they normally are interested. In cases where high-school pupils demonstrate little interest in safety, the teacher is probably lacking in such interest. It has definitely been proved that a negative or indifferent approach to safety problems often bores young people. If the safety program of instruction is to be successful, it is necessary that the teacher have the right understanding of the problem, be sympathetic toward it, and be able to present it in a way that will arouse the pupils' desire to do things in a skillful manner. In considering a high-school safety program, one must take into account certain adolescent characteristics, including a desire for adventure accompanied by a distaste for restraint. "There is no question that the high-school student, poised for a solo flight into life, and entering an age when his conduct affects the safety of others, stands in real need of the guidance that a safety program
can offer. Since safety is vitally concerned with a way of living every day of our lives, the teaching of safety offers an excellent opportunity for individuals to learn by doing rather than by studying mere subject matter. One of the first problems in such an undertaking is to enable the pupil to see that skillful living makes adventure possible, brings recognition through such avenues as proficiency in athletics, and secures the approval of one's companions. Although skillful living and safe living are synonymous, an approach to safety through the avenue of skills will usually prove to be far more effective with the high-school pupil than any other method.

Successful teaching methods in safety must take into account the interests and needs of the pupil. The high-school pupil is not inherently interested in safety; but he is interested in adventure, and desires recognition, social status, the approval of his fellows, a sense of mastery, and the thrill of power and accomplishment. Techniques of instruction that ignore or minimize these psychological characteristics of adolescent pupils cannot be effective.

Whenever practicable, classroom instruction in safety should be supplemented by the use of visual aids. Safety instruction is more effective if it, at times, brings in a certain amount of showmanship for emphasis upon vital points.

Classroom forums and discussions relating to specific safety problems that are pertinent to the experiences of high-school pupils is a good instructional method. Often the discussion may deal directly with the use of school equipment, such as shop materials and machines, athletic and gymnasium equipment, and instruments in the laboratories. The act of drawing up recommendations for the correction of hazardous conditions in or around the home or the school not only helps in the development of judgment and initiative, but also adds significant meaning to the safety instruction received in the school situations. "The effectiveness of teaching safety will be lost if we do not take advantage of the wide field of activating projects that surrounds us."  

Safety should be taught from a positive approach that points out first the right way of doing things and stresses this fact. Dangers should also be made clear, so that pupils will know what to expect when they do their work in a careless or improper manner. A student safety organization holds many possibilities as an effective means of checking up and improving safety practices.

"A good time to teach a subject is when the students are conscious of the need. Thus safety should be taught

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30Feadle, "What Are the Most Effective Methods of Teaching Safety Education in the Secondary School?" Safety Education Digest, a publication of New York University, 1940, pp. 12-13.
just before the students need to know or as near as possible to the time when they need to know."\(^{31}\)

**Accidents and Their Prevention**

Accidents do not just happen -- they are committed! In defining **accident**, it may be said that any mishap which causes injury to the boyd or a member of the body can be considered as an accident.\(^{32}\) A more comprehensive definition by a recognized authority in the field of accident prevention is as follows:

An accident is an event in which (a) the contact of a person with an object, substance, or another person, or (b) the exposure of a person to objects, substances, other persons, or conditions, or (c) the movement of a person, causes personal injury or suggests the probability of such injury.\(^{33}\)

It was only natural that when society began to be industrialized, and men on every hand were working with machines in the production of goods, accidents should increase and come to constitute a major problem in connection with the industrial era. What we now term the "power age" began in England early in the nineteenth century; but the births of industrial power and of industrial safety were by no means simultaneous. Industrial cities grew by leaps and bounds and, since building could not keep pace with the

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\(^{31}\) Department of Public Instruction (Pennsylvania), op. cit., p. 37.

\(^{32}\) Ibid., p. 5.  

\(^{33}\) Heinrich, op. cit., p. 15.
influx of residents, living and sanitary conditions were at once unspeakable. The death rate tripled almost over night in many of these factory centers. The factories themselves were little more than shacks, in which light, ventilation, and sanitation were wretched and sometimes non-existent. Two thirds of the workers were women and children who worked twelve and fourteen hours per day. Machine guards were unknown, and occupational deaths and maiming injuries were frightfully frequent.

Not until 1850 were some few improvements attempted — improvements which may be considered the first feeble efforts toward industrial safety. Legislation shortened working hours, established a minimum working age for children, and required some improvement in sanitary and safety conditions. In 1880 the English liability act was the world’s first statutory enactment to demand that the employer pay damages if a worker were killed through managerial negligence. In 1885 the state of Alabama became the first state in the United States to enact such a law, but Massachusetts followed in 1887. These statutes were the first indication to the employer that he was legally and therefore morally responsible for safeguarding his employees against accidents while on the job.

In 1897 a workmen’s compensation act was passed in Great Britain, to be followed in 1902 by similar legislation
in the state of Maryland, the first in the United States. In 1912 a small group of men interested in industrial safety met in Milwaukee, under the auspices of the Association of Iron and Steel Electrical Engineers. This group represented various types of industry, and included delegates from the federal and state governments as well. It was decided that through an exchange of ideas on a cooperative basis, much greater progress might be expected in the control of accidents. Out of this meeting grew the concept of a great national association that would act as a clearing house for the best ideas in accident prevention. A larger convention was called for the following year, to meet in New York City, and at this meeting the National Council for Industrial Safety was formally organized. The first activities of the Council were directed chiefly at the reduction of accidents in industry, but by 1915 the scope of activities had been extended into the field of public safety, and the name was changed to the National Safety Council, while the constitution was revised to include a program of public as well as industrial safety throughout the nation. Now hundreds of cities have local chapters of the National Safety Council, and thirty-eight states also have some kind of state-wide, organized effort for accident prevention, all working in close cooperation with the national council. Each year has witnessed marked improvement in industrial
safety, and at present the movement in the United States is far ahead of similar work in any other part of the world. Public consciousness has been awakened to the serious implications of public and industrial accidents, and chief credit for this awareness is due to the National Safety Council, which employs a permanent staff of one thousand research specialists to carry on a nation-wide campaign in accident prevention. The total program of the movement is closely related to the fundamental "three E's of safety" — education, engineering, and enforcement. While much has been done in all these fields, much yet remains to be done.34

For many years the safety movement in industry emphasized the safeguarding of machinery and the providing of good working conditions. Now the emphasis has been transferred to the worker himself. The accident records of many companies show that most personal injuries occur because of individual carelessness. Mishandling of tools, machines, and materials, neglecting to keep them in good condition, and leaving them lying around in dangerous places, are forms of carelessness that cause trouble sooner or later.

34 For concise but comprehensive discussions of the safety movement in industry, consult Heinrich, op. cit., pp. 375-384; National Safety Council, Safety Training for Vocational Schools and School Shops, pp. 53-60; Training for Safety, Bulletin 279 of the Michigan State Board of Control for Vocational Education, pp. 147-151; R. N. Trowbridge, Safety Education, pp. 3-7; R. P. Blake, "Industrial Safety Subjects" (mimeographed), Subject 15 (issued by the United States Department of Labor).
For this reason, every student must keep the thought of safety constantly in mind if he is to develop into the kind of worker wanted in the industrial shop. An unsafe worker is an unwanted worker. 35

As a part of the safety training provided by the public secondary schools, a knowledge of safety factors in industry should be cultivated. In this connection it is advisable to note the objectives of safety in industry and the methods employed by industry for their realization. These objectives and methods have been formulated by one authority in the manner shown in Table 2.

Each year some 18,000 industrial workers are accidentally killed at their jobs, and an additional 1,500,000 are so severely injured that they must either lose considerable time from their regular jobs or seek new forms of employment because of permanent physical disablement. It is estimated that industrial accidents cost employers over $600,000,000 annually. 36

To compensate for wage losses, the replacement of killed or injured workmen, accident compensation, etc., industry must add between five and six millions of dollars per year to the cost of manufactured products. 37


37Schaefer, op. cit., p. 3.
<table>
<thead>
<tr>
<th>Objectives</th>
<th>Materials and Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>To know of the extent of industrial accidents and the economic loss in</td>
<td>The extent of industrial accidents in the United States.</td>
</tr>
<tr>
<td>industry due to accidents.</td>
<td>How accident prevention in industry has developed.</td>
</tr>
<tr>
<td></td>
<td>The economic waste due to accidents.</td>
</tr>
<tr>
<td></td>
<td>Waste due to loss of life and injuries.</td>
</tr>
<tr>
<td></td>
<td>Waste in lost time and cost of accidents.</td>
</tr>
<tr>
<td></td>
<td>Why industries are interested in accident prevention.</td>
</tr>
<tr>
<td>To know what is being done in the industries in the community to reduce</td>
<td>A study of industries in the community to find out what is being done to reduce accidents.</td>
</tr>
<tr>
<td>accidents.</td>
<td>(Compare safety work in local industries with the national program in accident prevention.)</td>
</tr>
<tr>
<td>To know of the value of a safety program in accident prevention.</td>
<td>To find out what has been accomplished by certain industries in accident prevention.</td>
</tr>
<tr>
<td></td>
<td>1. The work of the U. S. Steel Corporation.</td>
</tr>
<tr>
<td></td>
<td>2. Accident reduction in mines.</td>
</tr>
<tr>
<td></td>
<td>3. The work of the Portland Cement Association.</td>
</tr>
<tr>
<td></td>
<td>4. The work of metal mines.</td>
</tr>
<tr>
<td></td>
<td>5. The work of other industries that have been successful in reducing accidents.</td>
</tr>
<tr>
<td></td>
<td>6. The relationship between safety and production.</td>
</tr>
<tr>
<td>To know what industries in general have found to be good practice in</td>
<td>Methods that have been found useful in safety programs:</td>
</tr>
<tr>
<td>reducing accidents.</td>
<td>1. Frequent inspections of the plant or the job to discover hazards both human and</td>
</tr>
<tr>
<td></td>
<td>mechanical.</td>
</tr>
<tr>
<td>Objectives</td>
<td>Materials and Activities</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>2. Providing guards for machinery and safeguarding other plant equipment and structure.</td>
<td>Diseases due to metal poisoning, such as lead, phosphorus, arsenic, brass, and zinc.</td>
</tr>
<tr>
<td>3. Campaigns, competition, and rewards.</td>
<td>Poisoning due to chemical products, such as benzol, creosote, turpentine, wood alcohol, ether, etc.</td>
</tr>
<tr>
<td>4. Educational posters, exhibits, and publicity.</td>
<td>Poisoning due to corrosive substances, such as lime, cement, acids, and alkalis.</td>
</tr>
<tr>
<td>5. Safety meetings and educational classes.</td>
<td>The comparative frequency of occupational diseases and accidents in industry.</td>
</tr>
<tr>
<td>7. Providing for accurate record keeping.</td>
<td></td>
</tr>
<tr>
<td>9. Requiring protective wearing material. (Gloves, goggles, etc.)</td>
<td></td>
</tr>
<tr>
<td>10. Improving health and sanitation.</td>
<td></td>
</tr>
<tr>
<td>11. Fire prevention and protection against dangerous chemicals, gases, etc.</td>
<td></td>
</tr>
<tr>
<td>12. Providing safety supervision and organization with committees for carrying out a definite safety program.</td>
<td></td>
</tr>
</tbody>
</table>

To know of the importance of some of the occupational diseases in industry.
### TABLE 2 -- Continued

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Materials and Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>To know what national and private organizations have been active in</td>
<td>Why accurate statistics on occupational diseases are not available.</td>
</tr>
<tr>
<td>promoting safety in industry.</td>
<td>How industry is preventing occupational diseases.</td>
</tr>
<tr>
<td></td>
<td>How &quot;caisson disease&quot; (bends) is prevented.</td>
</tr>
<tr>
<td></td>
<td>The comparative frequency of compensable occupational diseases.</td>
</tr>
<tr>
<td></td>
<td>The work of the Bureau of Mines.</td>
</tr>
<tr>
<td></td>
<td>The work of the state labor departments.</td>
</tr>
<tr>
<td></td>
<td>The work of private organizations, such as the National Safety Council and insurance</td>
</tr>
<tr>
<td></td>
<td>companies.</td>
</tr>
<tr>
<td></td>
<td>Why insurance companies are interested in accident prevention.</td>
</tr>
<tr>
<td>To learn the value of the workmen's compensation system.</td>
<td>How the provisions of the state workmen's compensation laws have influenced the movement</td>
</tr>
<tr>
<td></td>
<td>for safety.</td>
</tr>
</tbody>
</table>


That age and experience of workmen seem to influence accidents is indicated by the fact that, in 1938, in a plant employing 8,026 workers, 106 accidents occurred, twenty-four of them to men over fifty-five years of age. The accident frequency rate for the entire plant, regardless of age or
length of service, was 1.32 accidents per one hundred employees. New employees of six months or less had a frequency rate of 4.92, regardless of age. Thus the factor of experience seems, in this case, to have been more significant than age in accounting for the occurrence of occupational accidents.\(^3\)\(^8\)

In an effort to determine whether intelligence exerts any influence upon the frequency of accidents in industrial plants, one investigator surveyed a plant in which 6,829 men were classified as A, B, C, D, or E on the basis of intelligence tests, A representing the highest intelligence group and E the lowest. Of course, not all of the men were performing equally hazardous work; but the investigator believed that, on the whole, the less intelligent workers had less hazardous work to perform. The number of accidents per one hundred employees for each intelligence group is shown in Table 3. Members of each intelligence group were rather evenly divided as to old and new workers, age and youth, etc.

As to the results of the survey, the investigator makes the following statements:

First, the men of low intelligence were less capable of doing the same jobs or even less hazardous jobs than those of higher intelligence. Second, those of low intelligence did not grasp the instructions given concerning safe practice so readily as

\(^{38}\text{Ibid.}, \text{pp. 197-198.}\)
the others. If they do not grasp the significance of safety instruction readily, it must be specifically adapted to the individual; the lower the level of his intelligence, the more it becomes necessary that safety instruction be specifically adapted to the individual.39

TABLE 3

NUMBER OF ACCIDENTS PER YEAR PER 100 EMPLOYEES ON THE BASIS OF INTELLIGENCE

<table>
<thead>
<tr>
<th>Intelligence Group</th>
<th>Number of Employees</th>
<th>Number of Accidents per Year per 100 Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>A........</td>
<td>1,373</td>
<td>0.66</td>
</tr>
<tr>
<td>B........</td>
<td>1,606</td>
<td>1.12</td>
</tr>
<tr>
<td>C........</td>
<td>2,095</td>
<td>1.53</td>
</tr>
<tr>
<td>D........</td>
<td>1,393</td>
<td>2.08</td>
</tr>
<tr>
<td>E........</td>
<td>362</td>
<td>2.76</td>
</tr>
</tbody>
</table>

*Adapted from Schaefer, Safety Supervision, p. 192.

One encouraging fact concerning industrial accidents is that the number was reduced by sixty-one per cent during the period from 1926 to 1935. In view of this reduction in number, it is estimated that at least 25,000 lives were saved in the last quarter of a century by the concerted effort on the part of employers and employees to make occupational accidents the exception rather than the rule. An appalling condition, however, is indicated by the fact that from 1922 to 1936 accidents involving motor vehicles

39 Ibid., p. 193.
increased by 151 per cent.\textsuperscript{40} Whereas industrial mishaps have been on the decline, accidents on the highways have been mounting at a rapid pace. It is likely that war-time restrictions on the use and speed of automobiles will tend to decrease motor accidents to a new low figure.

Investigators have found that the majority of industrial accidents occur because the workers have not been properly trained in the safe ways to do their jobs, or else have not been sufficiently impressed with the need for exercising caution at their tasks. Years of experience in industrial plants have adequately demonstrated the fact that when a well-organized program for training employees in the detection and correction of unsafe mechanical conditions and unsafe job practices is in effect, accidents are materially reduced.\textsuperscript{41}

Every accident that occurs is the symptom of some underlying cause. On the whole, the result of an accident is not nearly so important as the unsafe practice or the hazardous condition which may continue to cause other accidents if not corrected. The causes of accidents in industry may be classified into two general groups: (1) physical, and (2) supervisory or human.\textsuperscript{42} The same general groupings of

\textsuperscript{40}Charles E. Dull, \textit{Safety First -- and Last}, p. 227.

\textsuperscript{41}National Safety Council, \textit{Safety Training for Vocational Schools and School Shops}, p. 5.

\textsuperscript{42}Schaefer, \textit{op. cit.}, p. 65.
accident causes may be applicable in almost any situation in which accidents may occur.

A concise presentation of the various factors included in these two groups is given in Table 4, which lists the principal types of accident causes from a personal or human point of view and from a mechanical or material point of view. Under each type are listed the contributing factors that have to do with the causation of accidents traceable to human and mechanical faults.

**TABLE 4**

**HUMAN AND MECHANICAL-MATERIAL FACTORS INVOLVED IN THE CAUSATION OF ACCIDENTS IN INDUSTRIAL PLANTS AND IN SCHOOL SHOPS**

<table>
<thead>
<tr>
<th>Human Factors</th>
<th>Mechanical-Material Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faulty instruction:</td>
<td>Physical hazards: Include mechanical, electrical, steam, chemical conditions, etc.</td>
</tr>
<tr>
<td>No instruction.</td>
<td>Ineffectively guarded.</td>
</tr>
<tr>
<td>Incomplete instruction.</td>
<td>Unguarded.</td>
</tr>
<tr>
<td>Erroneous instruction.</td>
<td>Unsafe design.</td>
</tr>
<tr>
<td>Instruction not enforced.</td>
<td></td>
</tr>
<tr>
<td>Lack of ability of those being instructed:</td>
<td>Poor housekeeping:</td>
</tr>
<tr>
<td>Lack of knowledge.</td>
<td>Improperly piled or stored materials.</td>
</tr>
<tr>
<td>Lack of aptitude.</td>
<td>Floors in poor condition.</td>
</tr>
<tr>
<td>Lack of experience.</td>
<td>Defective equipment, and failure to remedy known defects.</td>
</tr>
<tr>
<td>Poor judgment.</td>
<td>Fire hazards.</td>
</tr>
<tr>
<td>Poor discipline:</td>
<td>Defective equipment:</td>
</tr>
<tr>
<td>Disobedience of rules.</td>
<td>Miscellaneous materials and equipment.</td>
</tr>
<tr>
<td>Interference by others.</td>
<td>Tools.</td>
</tr>
<tr>
<td>Idling or fooling around.</td>
<td>Machines.</td>
</tr>
<tr>
<td>&quot;Horseplay&quot; and practical joking.</td>
<td></td>
</tr>
<tr>
<td>Human Factors</td>
<td>Mechanical-Material Factors</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Lack of concentration:</td>
<td></td>
</tr>
<tr>
<td>Attention distracted.</td>
<td></td>
</tr>
<tr>
<td>Inattention.</td>
<td></td>
</tr>
<tr>
<td>Excessive self-confidence.</td>
<td></td>
</tr>
<tr>
<td>Interest not sustained.</td>
<td></td>
</tr>
<tr>
<td>Improper attitudes.</td>
<td></td>
</tr>
<tr>
<td>Low morale.</td>
<td></td>
</tr>
<tr>
<td>Unsafe building conditions:</td>
<td></td>
</tr>
<tr>
<td>Fire protection.</td>
<td></td>
</tr>
<tr>
<td>Exits.</td>
<td></td>
</tr>
<tr>
<td>Floors.</td>
<td></td>
</tr>
<tr>
<td>Openings.</td>
<td></td>
</tr>
<tr>
<td>Poor lighting.</td>
<td></td>
</tr>
<tr>
<td>Crowded work space.</td>
<td></td>
</tr>
<tr>
<td>Poor ventilation.</td>
<td></td>
</tr>
<tr>
<td>Indifference toward safety in the plan of construction.</td>
<td></td>
</tr>
<tr>
<td>Unsafe practices:</td>
<td></td>
</tr>
<tr>
<td>Taking chances.</td>
<td></td>
</tr>
<tr>
<td>Short cuts.</td>
<td></td>
</tr>
<tr>
<td>Haste.</td>
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<td>Showing off.</td>
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<td>Bad work habits.</td>
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<td>Improper working conditions:</td>
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<td>Ventilation.</td>
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<td>Sanitation.</td>
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<td>Light.</td>
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<td>Poor housekeeping.</td>
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<td>Mentally and emotionally unfit:</td>
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<td>Sluggish or fatigued.</td>
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<td>Violent temper.</td>
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<td>Excitability.</td>
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<td>Apathetic.</td>
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<td>Unsafe practices.</td>
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<td>Poor muscular coordination.</td>
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<td>Improper dress or apparel:</td>
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<td>No goggles, gloves, masks, etc.</td>
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<td>Unsuitable long sleeves, high heels, defective attire, etc.</td>
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<td>Long, unruly hair.</td>
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<td>Dangling neckties.</td>
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*Adapted from Blake, op. cit., Subject 2, pp. 4-5; Heinrich, op. cit., p. 19; Schaefer, op. cit., pp. 72-73; Trowbridge, op. cit., p. 12; National Safety Council, Safety Training for Vocational Schools and School Shops, pp. 25-26.*
An important thing to remember is that almost all accidents may be avoided if one consistently pays strict attention to one’s own business. This can be done more effectively if efforts are made to create and maintain an active interest in safety on the part of all workers in the industrial plant or the industrial-vocational shop. Fact finding is a significant auxiliary to the maintenance of interest, for the facts connected with safety and accident prevention are challenging and provocative of concerted effort to mitigate the circumstances that permit or even encourage accidents. Any corrective action must be based only upon the facts, if it is to be successful. Remedial action, according to the conception of one authority in the field, may be grouped roughly into six classifications:

1. Education. -- Instruction in safe practice, providing proof and illustration, inspiring enthusiasm, convincing, etc.
2. Engineering revision. -- Guarding, redesign, relocation, etc.
3. Placing. -- Assignment of workers to relatively less hazardous work.
4. Discipline. -- Enforcement of rules, militaristic methods, penalties, etc.
5. Medical treatment. -- Treatment of bodily defects.
6. Psychology. -- Treatment of attitudes, etc.

Educators are aware of the fact that it is possible to direct and educate the mind so that semi-automatic habits

43Herman A. Graman, A Good Mechanic Seldom Gets Hurt, p. 10, quoting the Ohio Industrial Commission. (The exact preliminary source of the material quoted from the Ohio Industrial Commission could not be secured.)

44Heinrich, op. cit., p. 6
toward accident prevention are developed, as well as conscious efforts. There is good reason for the assumption that if adequate instruction in methods of accident prevention is provided during childhood and is continued through adolescence and adult life, the number of accidents incurred can be reduced to a half or even a quarter of their present number.\textsuperscript{46} It is certain that all effort toward accident prevention would be amply justified by the nature of the results obtained.

"Neglect is the forerunner of regret."\textsuperscript{47} This is true in all phases of safety and accident prevention. If the employer neglects to take every possible precaution to safeguard his workers and his property, sooner or later he will be consumed with regrets for his lack of foresight. If the school, in setting up its industrial and vocational shops, is neglectful of the safety interests of pupils and teachers, there will come a time when neglect will exact a tremendous price. If the individual worker in industry or the individual pupil in the shop is neglectful, he, too, will come to see that indifference toward safety precautions leads to regrets.

The fact that many industrial concerns have been successful in reducing the number of accidents to a very low figure is encouraging to all efforts for the attainment of

\textsuperscript{46}Vernon, \textit{op. cit.}, p. 1.

\textsuperscript{47}Graman, \textit{op. cit.}, p. 64, quoting the Ohio Industrial Commission.
similar results in the home, on the highways, in recreational activities, and in industrial-vocational school shops. In industry this result has been achieved through the erection of modern fireproof buildings, through the installation of all types of guards to prevent men from being caught in the machinery, through the awarding of prizes to competing groups for the reduction of accidents, through the installation of exhaust systems to carry out poisonous gases and chemicals, through providing gas masks and goggles for workmen, through the examination of workers for the detection of occupational diseases, and through the application and constant use of every safety device and practice which human ingenuity can produce for assuring the production of goods with a maximum of safety for the workers who operate the machines and carry out the varied processes of modern industry. 48

Industry has learned that "carelessness and inattention are what cause most accidents." 49 In the teaching of safety in schools, this fact must be kept uppermost in the consciousness of the teacher, to the end that the pupils will recognize the significance of exercising every possible precaution and of paying close attention to what they are doing. Only with this recognition will come the ability

48Dull, op. cit., p. 227.

49Graman, op. cit., p. 56, quoting the Ohio Industrial Commission.
to work safely and effectively in the school shop and in the varied pursuits of the industrial civilization of the present day.
CHAPTER III

DETERMINING THE EDUCATIONAL CONTRIBUTIONS OF
INDUSTRY TO SCHOOL SHOPS

Introduction

The need for safety first became apparent in the shops of industrial plants, and it was there that initial measures were taken for the safety of workers as they went about their business of production and the operation of machines. Industry had a severe handicap in that, for the most part, the workers were obliged to learn by trial and error how to practice safety and to prevent accidents to themselves and others. Oftentimes, the trial was very costly, and not infrequently the error was fatal. After the industrial era was already firmly launched, the educational system began to conceive of the role it might play in educating pupils to assume employment in industry following their departure from school. This new thought in education led to the establishment of vocational and industrial shops in schools, wherein pupils would receive instruction in the tasks of out-of-school industry and labor. Years after industry was already highly developed, the schools rose to the
responsibility of supplying capable workers for industry. Industry was grateful for the interest of education in the preparation of workers, and soon began to recommend that the educational system also provide organized methods in safety instruction similar to those employed by the large industrial plants. Early in their experience with machines and with the resultant accidents, industrial shops had learned that the learning of safety through trial and error is the poorest possible way, as well as the costliest to men and to industry. Most plants soon set up some type of organized safety program, or at least a system of rules for the safe operation of particular types of machines, and insisted that all employees be thoroughly acquainted with such organizations and systems, and be conscientious in the practice of safety precautions.

Interest in safety thus began in industry, where it should logically have had its genesis. But it was not long before the educational system had appropriated some of the fundamental safety measures and precautions which industry had found to be practicable, and had set about to acquaint the pupil with them before he was ready to assume an active position in industry. Unfortunately, the school, instead of leading the way in safety, has maintained its position as a follower in the path already blazed by industry. However, the educational system is doing a commendable job in
furnishing safety-conscious workers for industry, although it has continued to follow where the demands of industry have been most pronounced and insistent.

Industrial and vocational shops in secondary schools possess a real opportunity to extend safety education by reducing accidents in the shops themselves, and by producing workers who are at all times conscious of the importance of exercising every possible precaution against accident. The school recognizes the fact that the work habits established by the pupils will influence their habits later on when they are employed in industry, and is consequently insisting that jobs in the school shop be done in the safe way.

Because of the infrequency of severe accidents in vocational schools and school shops, it is sometimes difficult to arouse much interest in safety programs. Safety in school is by no means the only reason, however, for teaching accident prevention to pupils. A knowledge of applied safety is invaluable to the worker when he leaves the school for the factory or the foundry. "No one is prepared for industry if he does not know safety."

According to Bacon, nearly seven thousand children from five to fourteen years of age meet accidental death each

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1Graman, op. cit., p. 4, quoting the Ohio Industrial Commission.

2Bacon, op. cit., pp. 59-60.
year. About one third of these fatal accidents occur on school premises. Bacon\(^2\) states that the National Safety Council has estimated that approximately 3,000,000 days of absence of pupils from school occur each year because of accidents. This figure is equivalent to a continuous absence for an entire school year of approximately 17,000 pupils. So long as accident figures affecting school children are as startling as these, this fact alone would be sufficient justification for a comprehensive and all-out program of safety education in all American schools.

An analysis of accident statistics shows that certain types of accidents are particularly common during the period of junior and senior high school age. This is the period in which children are very generally learning to swim. It is the age of the Boy Scout and Girl Scout, of camping and adventure, hunting and fishing, experimenting and collecting. It is the age at which youth begins to stand alone and face some of the real problems of his environment.

It is natural, therefore, that during adolescence special stress in our schools should be placed on the prevention of the various types of accidents that are particularly common. Drowning, accidents from firearms, and electrical accidents have a leading place during this period.

The records of accidents during the junior and senior high school period will give us a criterion to show what subjects need to be stressed in education. For accidents are in a way indications of educational shortage; they are failures of human purpose. Sometimes this is the result of a lack of understanding, but more often it is a result of bad safety habits or attitudes. The high school boy driving the family car, who recklessly violates traffic rules and regulations and causes a serious accident is not so much actuated by a lack of knowledge about traffic rules as by a lack of good safety habits and attitudes.\(^3\)

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\(^2\)Ibid.

The teaching of safety in school shops is, without question, a most significant phase of industrial education. If pupils can be taught from the very first to employ safe habits of work, and safe habits only, they are apt to become safe workers when they grow up and join the ranks of industrial workers. This situation should result in a decrease in industrial accidents. It is highly important that pupils be taught to think continuously of the safe method of doing a job. If this is done, they will gradually acquire an attitude of mind which will carry over to other situations in the home, on the play field, on the streets, and, later, in industry.\(^4\)

Safety is largely a matter of thinking. A habit of safety may be developed through experience, instruction, and caution, and by the use of machine guards, slogans, posters, penalties, or a number of other schemes or devices, all undoubtedly having some value in encouraging safe practices. But the efficiency of any device or method of instruction in teaching people to be careful depends largely upon the extent to which the device helps to build up a point of view on how to go about any hazardous task in the best and least dangerous manner. Through regular instruction, the safety concept may be developed only when

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it is a part of the teacher's plan in giving instructions which properly emphasize safe procedures to be followed, and analyze the reasons for these procedures. Supplementary rules, devices, posters, and placards may be found effective, in varying proportion, as aids in some teaching situations, with different teachers or working conditions. Safety concepts, if they are to be worth while, must be developed according to a plan. The plan necessitates some connected thinking by the shop teacher, who may study the hazards, classify them as to their likelihood of occurrence, and decide upon the means that may be utilized to reduce occurrence to a minimum. Then comes the task of devising steps that may be taken to avoid recurrence, of analyzing the factors involved in accidents that have occurred so that the teacher may increase his knowledge of how to present safety instruction, of checking the value of his safety instruction, and of working out his own methods for thoroughly establishing the concepts in the minds of the pupils. A considerable portion of the job of teaching safety is contained in the teacher's regular plan of instruction in which he takes every practicable opportunity to develop an appreciation of the need for doing all work in the most economical and most careful manner.

The school shop presents three types of hazards: hazards to the worker, hazards to the tool or machine being used, and hazards to the material which the worker utilizes.
Toe often, shop teachers place so much emphasis on the first of these hazards that the other two are lost sight of. In doing so, teachers discard valuable opportunities to round out a comprehensive view of the problem of safety. It is hardly possible to build up a complete, usable, understandable practice of safety unless the instruction includes both the practices that will be best for the operator and those that encourage the habit of looking for potential dangers to the things with which the operator works.  

General Concepts of Safety for the School Shop

Before proceeding with a discussion of general concepts of safety for the school shop, it will perhaps be advisable to mention some of the phases of general school safety with particular attention to the entire school plant. One authority in the field has compiled the most comprehensive list of factors involved in the teaching of general school safety that the writer has found. His list, which is self-explanatory, is reproduced below:

1. Knowledge of where the hazards are on school grounds, buildings, etc.
2. Willingness to cooperate with pupils and teachers to prevent accidents.
3. The importance of good housekeeping in prevention of accidents.
4. A sense of one's own responsibility for prevention of accidents.
5. Knowledge of school fire hazards and how to escape in case of fire.

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6. To use stairways carefully.
7. To know what to do in a fire drill.
8. To be careful and alert in the laboratory.
9. To keep to the right on stairs and in corridors.
10. To follow the direction of teachers and patrol aides in all traffic situations.
11. Ability to demonstrate safe school living in any area of the program.
12. Appreciation of the safety program as a cooperative endeavor.
13. Appreciation of safe school living as basic to efficiency in education.
14. Avoidance of pushing, running, jumping, etc., in halls and stairways.
15. Dangers associated with the handling of chemicals in the laboratory.
16. How to escape unharmed from a room filled with smoke.
17. Care in the use of mats and other apparatus in the gymnasium.
18. Pupils should know what to do for another who has fainted.
19. Avoid wrestling in lunchroom and hallways.
20. Be careful in use of drinking fountains.
21. Careful of spreading colds or contagious skin diseases.
22. Proper ventilation to avoid colds.
23. Danger of jumping down the last two or three steps of stairs.
24. Keep aisles clear in classroom.
25. Where and when to cross the street when coming and going.
27. How school shop accidents are prevented.
28. How accidents are prevented in corridors and on stairs.
29. How accidents are prevented in the classroom.
30. Safety practices in the school kitchen and sewing room.
31. Respect for the safety of others in passing in and out of a building.
32. Correct attitude in the use of tools such as pencils, pens, etc.
33. To act as a leader in safety corps (when possible).
34. To develop habits of caution and self-control in group living.
35. Shower rooms are not play rooms (falls, scalding, etc.).
36. Saving a second's time on the stairs may cause an accident.
37. Know where low beams and dark recesses are and be careful in such areas.
38. Don't horseplay in school shops.
39. Should be safety conscious at all times.
40. Know what traffic controls have been made to protect people.
41. Know that most accidents are caused by someone's thoughtlessness and carelessness.
42. Develop an appreciation of industry's efforts to safeguard workers.
43. Develop an appreciation of the relationship between housing and safety.
44. Respect for the Safety Service Corps.
45. To be aware of the dangers which exist when surrounded by groups of children.
46. Knowledge of first aid for use in laboratory and shop accidents.
47. Respect and obey school safety patrols.
48. Definite knowledge of the "why" of fire drills.
49. Appreciation of importance of accident reporting and analysis.
50. To ride in the school bus in a safe and orderly manner.
51. Damaging school property may cause serious accidents.
52. To see that there is proper supervision of gymnasium and swimming-pool activities.
53. Know the value of good reading light; for example, while doing home work.
54. Avoid hitching and hitch-hiking.\(^6\)

As to general fundamental rules for safety in a school shop, one authority recommends the distribution to all pupils of printed copies of the following:

1. Get here on time -- tardiness is not permitted.
2. Once in the room, do not leave it without permission. . . .
3. When the whistle blows, come to attention instantly! This will save time for everybody and may prevent an accident.
4. Do not tamper with switches or window shades, nor with the lockers or materials of other pupils.

\(^6\)Kenneth N. Beadle et al., "Safety Instruction Material" (mimeographed), issued by the National Conservation Bureau, New York City, pp. 4-5.
5. Keep your fingers off all machines, even when they are not running, except when you have permission to use them.

6. These rules are made for your benefit; do not break them. If one pupil is permitted to break a rule, then all must be given the same privilege and there is no use having the rule.

7. Finally, woodwork [or metalwork] is an interesting subject and teaches many useful things. Why not take advantage of your opportunities? Try to believe that you can have more fun doing something useful than you can in loafing and getting into mischief.\(^7\)

Although the psychological approach of the above rules may be questioned in one or two respects, the idea behind having each pupil supplied with a list of general safety precautions is sound. Each shop situation may demand different rules, but a list of this type will be of value in any situation.

It is in the school shop that the pupil first learns to use edged tools and certain types of machines. Accidents may occur at times, but for the most part they can be avoided if proper precautions are taken. Most shop accidents arise from awkwardness and lack of familiarity with the tools and machines. The beginner would do well to stay away from the saws and planers until he has become somewhat skilled in the use of hand tools. Then he needs to watch some expert — preferably the instructor — use the machines before he attempts to operate them himself. All of the machines in a modern school shop are equipped with safety guards, which

\(^7\)Edward H. Crussell, "Safety Rules," Industrial Arts and Vocational Education, XXVII (October, 1938), 348.
should be in use at all times. Before one pupil turns on the power for any machine, he must first be sure that no other pupil is near the machine.8

The most effective type of work in safety education is through personal contact of instructors with pupils. This furnishes the instructor with the opportunity to detect unsafe practices through observation, and the student can be shown immediately how to perform the operation in a safe manner. However, in addition to this personal guidance, certain varieties of general educational work in safety are desirable. These may be summarized as follows:

1. Safety posters, suitably mounted on prominently placed bulletin boards, should be displayed and changed at frequent intervals. Posters that apply directly to the particular hazards of the shop should be obtained whenever possible.

2. Meetings of the students in departmental or larger groups may be held at intervals. The school principal or superintendent should preside at these meetings and help to inspire enthusiasm among the students. Men from local industries, where many of the students will later find jobs, and from state departments of labor may be invited to speak. Local safety councils can also help in these meetings.

3. Motion pictures or film strips with appropriate lectures may be presented when convenient. Some school shops have developed their own film strips or stereopticon slides to help impress shop hazards on students.

4. Questions arranged to apply to the safe performance of jobs or to the safeguarding of machines are included in examinations occasionally.

5. Visits may be made to local industrial plants, at which time safety features can be pointed out.

8Dull, op. cit., p. 208.
Also, after the class has returned, each student may be asked to name the unsafe acts or conditions that came to his attention.

6. Meetings of all instructors, of all committee chairmen, or of all committeemen may be held occasionally.

7. Notices regarding progress in accident prevention may be prepared and posted on the bulletin board.

8. Competition in accident prevention may be carried on between the various school shops or departments.

9. Personal letters of commendation may be prepared by the chief executives of the school and sent to various departments where they can be displayed on bulletin boards.

10. Under the direction of the instructor, groups of students may undertake detailed studies of various operations and compile sets of safe operating rules. Their results can be checked with other authentic data and operating codes set up for each job that must be performed.\(^9\)

That safety in the school shop is important as a consideration for educators is exemplified by the fact that Hughes\(^{10}\) in a comprehensive survey of accidents and safety in secondary schools throughout the nation, found that the school shop is surpassed as a center of accident frequency by only one other area of activity in the school, the gymnasium. Hughes\(^{11}\) discovered that safety is taught principally through the media of demonstrations, individual and group instruction, visual aids, units in the shop courses, visits to industrial plants, and printed and verbal rules


\(^{11}\)Ibid., p. 234.
for personal safety and the safe use of hand tools and ma-
chines. He concluded that all too little emphasis is placed
upon the value of student safety committees and student
safety inspectors and foremen.

One of the first steps that must be taken in the de-
velopment of safety concepts in the school shop is the
cultivation in the pupils of desirable habits and atti-
tudes in connection with the work they perform in the shop.
According to Prosser and Van Wyck,12 the following important
habits and attitudes should be in evidence:

1. Cleanliness.
2. Good personal appearance.
3. Ability to get along with others.
4. Ability and willingness to follow others and di-
rections.
5. Promptness.
6. Characteristic of keeping busy.
7. Ability to see the job through.
8. Ability to check and correct own work.
9. Desire to do accurate work.
11. Neatness of work.
12. Cooperation with others.

12List compiled by the writer from a chart appearing
in Prosser and Van Wyck, op. cit., p. 10.
14. Proper conduct on the job.
15. Orderly procedure.
16. Proper care of tools, equipment, materials, and supplies.
17. Proper use of tools and power equipment.
18. Economy in use of materials and supplies.
20. Safety and health precautions.

These habits and attitudes are equally important in the wood and the metal shops, and in each are essential to the performance of efficient and safe work. Although little research has been done in an effort to determine the relative number of accidents which occur in the school woodshop and the school metalshop, it is likely that when such statistics are made available, they will disclose that a considerably larger number of accidents occur in the woodshop than in the metalshop. This fact is supported by Shallenberger, who points out that (1) woodworking machines are operated at much higher speeds, (2) cutters are usually obscured from view, (3) material is generally fed by hand, and (4) the wood saw breaks far more frequently and with greater danger to the operator than is true of any machine in the metalshop.

In all school shops, machine tools should be guarded so

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as to conform to state requirements for safety, or to those
recommended by such authoritative agencies as the National
Safety Council. All machines should be controlled by a
master switch, and each motor should be independently fused
and operated by an overload and under-voltage control.
Hand tools should always be in good condition; that is, they
should be sharp, and handles should be secure. Inflammable
materials should be stored in fireproof cabinets, and recom-
mandations of fire underwriters and of the fire department
regarding their care should be scrupulously followed. Shops
should be clean and in order; stock and machine parts should
be arranged in orderly stacks, or kept in bins or on racks.
Floors should be kept clean, and tools should be properly
stored and kept in order.

Van Duzee\textsuperscript{14} suggests that instruction in safety should
consist of three phases: (1) the demonstration and giving
of information, (2) the test for knowledge and for the abili-
ty to perform the operation safely, and (3) the preparation
of a record of signatures of all pupils who have proved to
the instructor that they have mastered the safe operation of
a given machine or tool. The liability of teachers in case
of accidents to pupils has its basis in negligence. There
is no negligence where all reasonable efforts have been made
to teach the safe use of equipment and to maintain proper

\textsuperscript{14}R. R. Van Duzee, "Safety in School Shops," \textit{Industrial}
Arts and Vocational Education, XXX (September, 1941), 267-
270, 385.
shop atmosphere for work. Each pupil should have the adjustment, care, and operation of all dangerous equipment demonstrated to him either in a group or individually. Further, the pupil should study the instruction sheet on the equipment and respond to an objective type of test on the equipment to be used. A record of the signatures of pupils who have received instruction in the operation of each machine or dangerous tool, and who have demonstrated their ability to use it efficiently and safely, should be kept by the shop instructor. Experience has shown that the accident ratio in school shops is less than it is in many activities which are not thought of as being dangerous. This fact is probably produced by the emphasis that is placed on safety instruction in school shops.

Among general recommendations for the safety program in the industrial-arts or vocational-education shop of the secondary school, the following are advanced by the Pennsylvania Department of Public Instruction:  

1. No angry person should be permitted to work with power machinery or in a hazardous location.

2. Pupils should be encouraged to confer with the instructor whenever they are in doubt about the operation of power machinery or the use of hand tools.

15Department of Public Instruction (Pennsylvania), op. cit., pp. 10-19. See also Graman, op. cit., pp. 5-10.
3. No one should ever make an attempt to stop a machine by grabbing a belt or a moving part.

4. When there is the possibility of the worker's hair becoming caught in moving machinery or of catching fire, he should wear a protective cap at all times.

5. All rags, scraps of wood or metal, shavings, packing materials, paper, and all other inflammable material should be cleaned up at least once daily from under work-benches, from behind machines, and from all other spaces. Before pupils are permitted to clean up their machines, the main power switch should be thrown out and securely locked.

6. Pupils should treat their shop mates with courtesy and work in harmony with them.

7. Crowded conditions should always be avoided. A minimum of at least forty square feet per student is usually needed in the average shop.

8. Avoid the use of broken tools, splintered handles, improperly tempered tools, mushroomed tools, improperly designed equipment, damaged or rotted ladders, worn or rotted rope, etc.

9. When materials are stacked or piled, care should always be taken to maintain the balance of the pile to avoid the hazard of falling or slipping objects.

10. Machine safeguards should be used at all times, should never be removed without the instructor's permission, and should always be checked by the instructor after they are replaced.
11. When needed, protective clothing such as special shoes and goggles should be worn at all times.

12. In handling stock, special care should be exercised, as splinters and metal-cut accidents are numerous, due chiefly to sliding stock through hands or to failing to fasten stock securely while working with it.

13. Haste should be avoided in school shops. Special warning safety precautions should be taken and haste avoided during the last month of each semester, when accidents are more numerous.

14. Every pupil should be carefully instructed in the effective and safe use of every hand tool, and should demonstrate to the instructor that he has mastered the instruction before he is permitted to handle the tool "on his own."

15. Practical joking, fooling, and "horseplay" in shops must not be tolerated.

16. When a person is operating any machine, conversation between the operator and any other person should be prohibited. If instructions are necessary, the machine should be stopped.
17. No one should lean on a machine while it is in operation. At all times, keep at a safe distance from all moving parts.

18. When a machine is out of order, it should be marked with an "out of order" sign, or else the electric switch should be locked.

19. Obsolete equipment which cannot be brought up to present safety standards should be discarded.

20. Machinery should never be oiled while it is in motion.

21. All possible precautions should be taken to avoid spontaneous combustion.

22. Safety zones for the operator should be established around each machine. Painted lines on the floor are usually satisfactory. When a pupil is operating a machine, no one except the instructor shall be allowed within the safety zone, and no one outside the line shall be permitted to talk with the operator.

23. Pupils should operate machines only by permission from the instructor.

24. Pupils should endeavor to acquire habits of caution for their own protection and that of their shop mates. They should cultivate careful, thoughtful, and deliberate habits of work and develop safety consciousness as an attitude of mind.
25. One safety measure that should prevail in all shops is that of keeping all tools sharp. Dull tools are dangerous. This is especially true of dull circular saws.

26. Slipping hazards should be eliminated as soon as they occur. Puddles or drippings of oil, grease, water, or other liquids should be rendered harmless by mopping up and strewing sand or sawdust on the floor until the floor is dry.

Figs. 2 and 3. — Puddles of water or grease are serious slipping hazards. They cannot be cleaned up too quickly.

27. Proper supervision is probably the best accident preventative at the command of the shop teacher. With the proper shop organization the instructor should be able to spend most of his time moving about the shop, constantly observing the progress of all operations, both from the standpoint of proficiency and from that of safety. Proper supervision cannot be achieved from a desk.

28. Form the habit of never standing in line with
swiftly revolving parts, such as grinding wheels, pulleys, saws, and jointers.

29. Before power is turned on, every machine should be carefully examined to make sure that all parts are in working order. If it is possible, the machine should be turned by hand to be sure all moving parts are free.

30. Hand tools should not be permitted to lie on the floor or working platform when they are not in use for any length of time. They should always be placed in their proper storage places when they are not being used.


32. Machines should be operated only when the teacher is in the shop. Main switches in the shop should be pulled and the door on the panel box locked whenever the teacher leaves the shop.

33. Ill health, worry, lack of sleep, dissipation, over-work, etc., cause sluggishness. Persons thus afflicted cannot give strict attention to their work.

34. The instructor should personally see that the power switch at every machine is released before the main power supply is turned on. When starting power machinery or throwing on electrical current, the instructor should always caution pupils to stand clear of machines.

35. When operating a machine, the student should give his undivided attention to the work that he is doing.
36. In every job situation, certain processes are known to be dangerous. These should be emphasized by the instructor, and should be carefully avoided by the pupils.

37. All wrenches should be used only for the purpose for which they were made. Never use an oversize wrench because it happens to be more convenient than the correct size, and do not try to make an oversize wrench fit by using thin strips of wood or metal as shims. Wrenches should never be used as hammers.

Rules for the safe and effective performance of work in the school shop are summarized by Blake\(^\text{16}\) under the following vital procedures:

1. Careful, thorough planning of each specific job and the methods of handling the work.

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\(^{16}\)Blake, "Industrial Safety Subjects" (mimeographed), Subject 10, p. 3.
2. Adequate equipment suited to the kind of work or the type of job.

3. Careful maintenance of all equipment.

4. Foresight in anticipating the hazards that may be encountered and in devising means of control.

5. Supervision suited to the hazards of the work and the safety-mindedness of the workers.

6. Selection of pupils with the necessary judgment, mental alertness, and physical coordination for the performance of specific jobs.

7. Training suited to the capabilities and experience of the pupil; hence, personalized training in safety and efficiency.

8. Careful attention to the adequacy and maintenance of personal protective equipment and its proper use.

For the most part, the safety activities of the industrial-arts and vocational-education department of the secondary school will consist of the following:

1. Keeping accurate records for the purpose of getting at the facts.

2. Making studies of shops for the purpose of installing safeguards and improving the safety of shop practices.

3. Safety instruction given in each shop or given partly as academic subject matter.

4. Safety campaigns of various types.

5. Visiting industries to observe provisions for safety.17

The Teacher's Responsibility
in the Safety Program

In the safety program of the school shop the teacher naturally possesses a vital role -- that of defining hazards, of demonstrating safety precautions, of supervising the pupils in the performance of efficient work in a safe manner, and of observing their progress and showing them how to improve their techniques. The material presented in Table 5 indicates how the instructor determines safety content in connection with any specific job, how the instructor uses the safety content, and how the pupil learns and acts on the basis of the safety content.

The industrial-arts and vocational-education instructor should supervise and direct the work of all shop committees, of which he may serve as an ex officio member. He should point out all shop and machine hazards not noticed by the student safety committees or inspectors, and he should see that all forms are correctly filled in and that all accident-producing conditions are correctly analyzed. Above all, he should make it known that the student safety committees in the shop have his full support, and he should insist that the committees' safety rules and recommendations shall be observed by all pupils at all times. He should aim to develop a safety consciousness in every student; this is as important as helping the pupil to achieve proficiency on the job. He should encourage the safety committees to
<table>
<thead>
<tr>
<th>Instructor Finds What to Teach by Asking and Answering These Questions</th>
<th>Instructor Puts Over the Answers</th>
<th>Pupil Learns and Acts</th>
</tr>
</thead>
<tbody>
<tr>
<td>What danger points on job?</td>
<td>Shows, explains danger points.</td>
<td>Learns danger points.</td>
</tr>
<tr>
<td>What may cause accidents on job?</td>
<td>Explains causes of accidents.</td>
<td>Learns causes of accidents.</td>
</tr>
<tr>
<td>What safeguards should be used?</td>
<td>Shows need for safeguards.</td>
<td>Learns need of safeguards.</td>
</tr>
<tr>
<td>How do safeguards work?</td>
<td>Demonstrates safeguards.</td>
<td>Learns to use safeguards.</td>
</tr>
<tr>
<td>Why must safeguards always be used?</td>
<td>Enforces constant use of safeguards.</td>
<td>Practices constant use of safeguards.</td>
</tr>
<tr>
<td>What personal hygiene necessary?</td>
<td>Explains and enforces personal hygiene.</td>
<td>Learns and practices personal hygiene.</td>
</tr>
<tr>
<td>What emergencies may occur?</td>
<td>Explains possible emergencies.</td>
<td>Learns possible emergencies.</td>
</tr>
<tr>
<td>How meet emergencies?</td>
<td>Explains how to meet emergencies.</td>
<td>Learns how to meet emergencies.</td>
</tr>
<tr>
<td>What first aid may be needed?</td>
<td>Explains need for first aid.</td>
<td>Learns need for first aid.</td>
</tr>
</tbody>
</table>
### TABLE 5 -- Continued

<table>
<thead>
<tr>
<th>Instructor Finds What to Teach by Asking and Answering These Questions</th>
<th>Instructor Puts Over the Answers</th>
<th>Pupil Learns and Acts</th>
</tr>
</thead>
<tbody>
<tr>
<td>How is this first aid given?</td>
<td>Demonstrates first aid.</td>
<td>Learns and practices first aid.</td>
</tr>
<tr>
<td>What safety and health regulations apply?</td>
<td>Sets up and explains safety, health regulations.</td>
<td>Learns safety and health regulations.</td>
</tr>
<tr>
<td>Why must these always be obeyed?</td>
<td>Enforces constant use of regulations.</td>
<td>Practices safety and health regulations.</td>
</tr>
<tr>
<td>Any other question or questions?</td>
<td>Puts over answer to this question.</td>
<td>Learns and practices answer to this question.</td>
</tr>
</tbody>
</table>

*Adapted from Prosser and Van Wyck, op. cit., p. 34.

Assume the initiative in correcting unsafe conditions, rather than to remain dependent upon the shop instructor.

The National Safety Council\(^\text{18}\) maintains that it is highly necessary that the shop teacher observe all safety rules himself. Under no condition must he utilize a practice that, if emulated, might cause injury to inexperienced pupils who are not so adept as he is in the shop situation. He should constantly observe the same precautions that would be necessary under the most dangerous conditions.

All school shop teachers should have a thorough knowledge of all safety rules and regulations pertaining to their particular shops. A discussion of some phase of safety education should be given at least once a month to each class. Instruction in safety should also be integrated with work procedures at every opportunity, thus making training in safe work practices functional. Safe rules of procedure and conduct are for the good of each individual person. If we expect to benefit by them, we must respect and promote them in school shops, laboratories, industry, the home, civic groups, or in any situation or organization where the effectiveness of safe training may be enhanced.¹⁹

In the teaching of safety, shop talks on accidents and accident prevention, posters showing the results of accidents, posters visualizing the dire effects of carelessness, descriptive and illustrative pamphlets, and competition and contests between departments or classes in the development of safety, all have been found to be feasible, desirable, and effective.²⁰

To the credit of shop teachers it can be asserted that, to an increasing degree, they are emphasizing and practicing the elements of safety education. Many shop teachers reflect practical applications of safety in all of their work. Their students learn more from example than from precept—a most effective way of teaching. They also devote time to teaching safe ways of doing things, such as what precautions to take and how to cooperate in school groups in the interest of safety. Fortunately, the shop teachers who look with

²⁰Ibid., p. 7.
indifference upon mechanical safeguards and who regard all safety programs as unnecessary or nonsensical, are becoming fewer in number; although occasionally one can still be encountered who maintains that a certain number of accidents are bound to occur despite any effort toward their prevention. The efficient industrial-arts teacher who assumes a professional attitude toward his work is confronted with numerous problems, such as seeing that all mechanical safety devices are constantly in place, that light and ventilation are adequate, that good-housekeeping habits are constantly in force, and that, above all, pupils are instructed in safe ways of doing all the tasks that come to them in the school shop. Shop teachers of today can profit greatly by keeping in close touch with the safety programs and practices that are coming to be characteristic of modern industry. Since industry is deeply concerned with safety education and with the elimination of accident hazards, the school shop can profit much by a careful recognition on the part of teacher and pupils that industry can make many worthwhile contributions to safety efforts among pupils who are learning industrial procedures in the shops of the public schools.\textsuperscript{21}

In his functions in the school-shop situation, according to Prosser and Van Wyck,\textsuperscript{22} the instructor performs three

\textsuperscript{21}Department of Public Instruction (Pennsylvania), \textit{Safety Education in Industrial School Shops}, pp. 6-8.

\textsuperscript{22}Prosser and Van Wyck, \textit{op. cit.}, pp. 12-18.
distinct types of activities, which may be defined as follows:

1. Management -- planning, executing, correcting.
2. Supervision -- checking results and causes.
3. Training -- instruction and habit formation.

Although these respective functions of the shop teacher are closely related and interdependent, each of them possesses distinct phases and procedures. For example, Prosser and Van Wyck 23 say that the teacher as a manager within the shop performs the following eleven functions:

1. Planning the job and correcting troubles.
2. Carrying out a safety program.
3. Selecting tools, equipment, materials, supplies.
4. Organizing the use of tools, equipment, materials, supplies.
5. Setting up performance steps in doing the job.
6. Setting up procedures in performance steps.
7. Setting up procedures in training the pupil to be an efficient workman.
8. Handling personnel problems.
9. Setting up procedures for inspecting and correcting work.
10. Setting up procedures for cleaning up and for returning tools, equipment, materials, and supplies to their proper storage places.

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23 Ibid.
11. Controlling the cost of the project.

The supervisory functions of the shop teacher may be designated as inspection and "trouble shooting." They may be defined as follows:

1. Planning the supervision.
2. Supervising the safety program.
3. Supervising the selection of tools, equipment, materials, and supplies.
4. Supervising the use of tools, equipment, materials, and supplies.
5. Supervising the performance steps in doing the job.
7. Supervising the training of pupils so that they may become proficient workmen.
8. Supervising personnel problems.
9. Supervising the inspection and correction of work.
10. Supervising the cleaning-up activities and the returning of tools, equipment, materials, and supplies to their proper storage places.
11. Supervising cost control.

In all of these functions the shop teacher serves as a trainer of pupils, helping them to develop habits, skills, and attitudes that will contribute to their efficiency in the industrial and economic spheres in which they will later assume responsibility. In the management of shop affairs
the teacher sets the example of efficient managerial procedures, and in his supervisory activities he shows the pupils how to perform tasks with the utmost efficiency and the highest degree of safety. The teacher is a guide, a helper, an example, to the end that pupils may be inspired to put forth their best efforts in the interest of the safe accomplishment of the work at hand.

The Pupil's Responsibility in the Shop Safety Program

Although formal safety instruction and supervision by the shop instructor are necessary, safety work, to be most effective, must be carried on by the students themselves. A mere knowledge of what to do in the shop and of how to do it safely is not enough; students should be given the privilege and experience of actually carrying on the work of accident prevention and thus, while helping the teacher to keep class accidents at a minimum, prepare themselves for effective and safe industrial work later on.

One of the best ways to teach accident prevention in the school shop or laboratory is to have pupils carry on a safety program in much the same way as the best safety programs in industry are carried on. Always, the best results are obtained with a definite plan or program. Progress in safety is not something that can just happen -- it has to be planned. To arrive at the most practical method of
procedure requires careful study and experimentation. The most successful programs of safety in the school shop are based upon three fundamental principles of safety work:

1. Interest, support, and personal participation by the administrative heads of the school system, including the head of the vocational department.

2. A knowledge of the facts of accident causation as they apply to specific shop operations.

3. Proper corrective action to control specific causes.24

Each of these fundamentals in safety work necessitates a personal consciousness of safety procedures on the part of the individual. After all, safety education, although it may be imparted in group situations, is, in the last analysis, a personal and individual thing. The individual is the one who determines whether safety is to be practiced, and how effectively the safety program is to function. The group may learn safety habits and practices, but only the individual can put them into use. In building up an attitude of mind on the part of the individual, the National Safety Council25 recommends the following articles in a personal code of safety as applicable to the school shop:

1. I will work safely on each job on which I am employed.

2. I will help others to work safely, and will take an active part in the safety program of my school and shop.


3. I will inspect my shop for hazardous conditions, report them to the proper authorities, and do all I can to correct them.

4. I will discuss safety matters with my friends and fellow workers in the shop.

5. I will try to encourage interest in accident prevention in all the organizations of which I am a member, and will try to influence each of them to carry out some definite safety activities.

6. I will support by my personal influence and enthusiasm all the safety work carried on in my community and in my school.

Probably one of the best ways to cause each pupil to be conscious of his responsibility in promoting safety in the school shop is to organize a student safety committee. Such a committee should be set up in each shop class. The work of this student safety committee should be closely supervised by the shop instructor. Four members for the committee is the number recommended. The personnel is to be selected by the shop teacher or teachers, and is to be alternated frequently enough to insure that each member of the class may have an opportunity to serve on the committee during the semester or the school term. The committee setup may be made more democratic by permitting the class to
select the personnel of the committee, or by asking each retiring committeeman to appoint his successor. If this method is utilized, the instructor must see to it that favoritism is not shown, and that no person serves more than one term on the committee until everyone in the group has functioned as a committeeman.

Fig. 5. -- Be sure that your goggles fit comfortably and securely. This is part of your responsibility in the safety program.

Fig. 6. -- One part of the pupil's responsibility in safety is to dress for his job. Note goggles, safety shoes, and absence of loose clothing.

The committee may select one of its members as a chairman, who will call the meetings, announce the time and place, and personally contact all members of the committee, urging them to be present. Regular weekly meetings are recommended, and special emergency meetings may be held
at any time when the need arises. The chairman of the committee presides, sees that all reports on safety and accidents are up to date and, when necessary, submitted to the proper authorities. He carefully checks the progress of accident control in the shop, and sees that charts are made to show accident frequency in comparison to the hours of work and the number of students.

The secretary will be responsible for keeping written minutes of all committee meetings, and will have charge of all necessary records and look after all other clerical work. He customarily sends copies of all accident reports to the administrative office and to the executive council of the school.

One member of the safety committee or council is the safety inspector, who is responsible for making detailed inspections of the shop and of all projects at least once a week. These inspections should be made shortly before the weekly meetings of the committee, so the committee may hear an up-to-the-minute report of the safety inspector's findings. The safety inspector should be considered the most important student safety officer of the shop or department. He sees that machines are properly guarded and safely operated at all times; he looks into the condition of the first-aid kit or cabinet; he reports on the effectiveness of the safety bulletin board; he investigates and reports
his findings on the condition of housekeeping in evidence in the shop, on the degree to which pupils are properly dressed for their respective jobs, and on whether safe practices are used in handling and operating tools, machines, equipment, and materials. He records and reports all unsafe or questionable conditions; he investigates all accidents that occur in the shop, determines the unsafe acts and the unsafe physical and mechanical conditions involved in the accidents, and makes recommendations for improving the situation so that other similar accidents may be decreased in number or entirely eliminated. The inspector is responsible, of course, for bringing all of his findings before the safety council for discussion and action.

Every meeting of the safety committee should be conducted in accordance with an outline, prepared in advance by the secretary or the chairman. According to the National Safety Council,26 this outline should always include the following items:

1. Reading of the minutes of the last meeting, including all items previously discussed but not fully disposed of.

2. Reports of all accidents occurring in the shop or the department since the last meeting, presented on report

\[26\] National Safety Council, Safety Training for Vocational Schools and School Shops, pp. 12-15. (See also Bacon, op. cit., pp. 70-73; Heinrich, op. cit., pp. 314-322; Blake, op. cit., Subject 15.)
forms and submitted for discussion by the safety inspector.

3. Reports and recommendations concerning shop conditions having to do with the safety program, presented by the safety inspector.

4. Reports and recommendations from any other source.

5. A report by the secretary showing the trend of accident frequency for the shop in terms of outstanding types of accidents and specific unsafe practices or unsafe physical or mechanical conditions.

6. A report showing accident proneness by an individual or a group, or unfortunate experiences on any specific operation in the shop.

The safety inspector in the school shop is the equivalent of the safety engineer in industrial plants, and his responsibilities, in comparison, are fully as important. He cautions all pupils about hazards of clothing, work habits, carelessness, and so on. He inspects machinery and tools to see that they are in satisfactory working order and are made as safe as possible by mechanical devices and safeguards. He watches for the improper handling of machinery or equipment, and warns about the consequences. He looks after the housekeeping habits of the pupils and encourages them to be neat and orderly. He is on the lookout at all times for conduct, habits, attitudes, and physical and mechanical conditions that are not conducive to the safe and
efficient performance of all the jobs that are characteristic of the school shop.\textsuperscript{27}

In a shop situation in which the pupils have one of their own number as safety inspector, and in which each of them has served, is serving, or will serve as a responsible member of the shop safety council, much incentive is provided for the development of a personal interest in the safe performance of work and in the safe handling of tools and machines. The greater the degree of responsibility for accident control in the school shop which the pupil can be induced to assume, the deeper will be his determination to work safely himself and to demonstrate to his shop fellows how they may do so.

The Function of Visual Aids in the Shop Safety Program

The following discussion of visual aids in relation to the shop safety program is based upon the findings and recommendations of Reitze,\textsuperscript{28} Schaefer,\textsuperscript{29} and the National Safety Council.\textsuperscript{30}

\textsuperscript{27}Comprehensive treatments of the duties and responsibilities of the safety inspector in the school shop are found in: Department of Public Instruction (Pennsylvania), \textit{op. cit.}, pp. 35-36; American Association of School Administrators, \textit{op. cit.}, pp. 117-120; Training for Safety, Bulletin 279 of the Michigan State Board of Control for Vocational Education, pp. 18-23; Blake, \textit{op. cit.}, Subject 13; National Safety Council, \textit{Safety Inspection}, Safety Instruction Cards No. 325 and 333.

\textsuperscript{28}A. W. Reitze, "Visual Aids in Safety Education," \textit{Industrial Arts and Vocational Education}, XXIII (September, 1934), 272-274.

\textsuperscript{29}Schaefer, \textit{op. cit.}, pp. 11-12.

"Visual aids" are such teaching devices as are primarily based upon the sense of vision for their effectiveness. They include motion pictures, lantern slides, posters, charts, photographs, cartoons, and dramatic presentations.

That visual aids in the teaching of safety have value is demonstrated by the fact that industry, which is largely interested in the definite economic value of a method, has so wholeheartedly adopted them in its safety campaigns. Thousands of safety posters are in daily use in practically every industry. Many motion-picture films have been made solely for the purpose of teaching safety to the employees in industrial plants. In addition, many factories have set up safety museums where safety devices are shown and demonstrated. Strange to say, however, the schools, for the most part, have been slow to follow in the footsteps of industry in attempting to teach this most vital subject. Shop teachers, in their efforts to develop safety consciousness on the part of their pupils, have depended upon a few general talks on safety and on a few posters, which, after being placed on the shop walls or on the bulletin board, are promptly forgotten, and have not adequately utilized the possibilities inherent in visual aids.

It is true that the most effective way of teaching safety in the school shop is the actual practice of safety when using tools, machines, and equipment in the shop, yet
at times it is difficult to show the proper safety precautions on certain machines to an entire class. In demonstrating safety precautions, it is frequently necessary to have machinery in operation, which makes it difficult for the class or group to hear what is said by the teacher. The group is also highly interested in watching the machine in operation, and hence do not get the full benefit of what is said. Also, many safety devices on machines are in such positions that it is hard even for one individual to see them, and practically impossible to show them to a group. These are but a few of the difficulties which arise in attempting to teach the safe use of machines by actual demonstration.

By the use of visual aids many of these difficulties can be minimized, and safety instruction be made more effective. Lantern slides, moving pictures, or charts presenting various safety precautions and devices can be shown so that each member of the group can readily see what the teacher wants him to see and comprehend. By the same means, the result of neglecting to use the safety devices or to heed the safety instructions and precautions can be shown without danger to persons or machines. The use of these visual aids is not accompanied by distracting noises which may prevent some from hearing, nor do they cause the class to become distracted by the actual motion of the
machine. With visual aids, the attention of the class can be definitely focused on what is being discussed. Also, through the use of visual aids, even the safety devices, and hidden dangers which it is extremely difficult to show to a group, can be clearly portrayed.

The charts and slides may be made by the teacher and pupils, or they may be obtained commercially. Even motion pictures can be made if the school possesses the necessary equipment; and many educational contributions can result from such activities.

Another effective visual aid for use in the school shop is the poster depicting the correct method of using tools and equipment. Such posters may show the proper manner of carrying sharp-edged tools, the need of removing nails before discarding a board, etc., and also the results of failure to observe these fundamental precautions. But it should not be expected that such posters, excellent though they may be, will suffice to teach safety without the teacher's help. Posters can perhaps be most effectively utilized by briefly discussing them with the class and then posting them on the bulletin board for a period of a week or two. They should then be replaced by others and perhaps used again later. This frequent change is to prevent their becoming a dead issue with the pupils, which is likely to happen with any chart or poster kept too long before a class.
The number of posters displayed at any one time should be limited. It is much better to enter into a thorough discussion of one or two posters with the class at a time than to use a large number indiscriminately. It is possible to make safety posters in the school shop or in the mechanical drawing or art departments, but commercially obtained posters are usually more effective and show the point more clearly than can ordinarily be done with pupil talent. Excellent posters on safety can be obtained at a small cost from the National Safety Council, Chicago, and from the Elliott Service Company, New York. Practically all of the available posters are colorful and positive in appeal, and are definitely helpful in promoting interest in accident prevention and safe practices. Safety-first slogans, signs, and symbols often become a part of the every-day vocabulary of students. From time to time, the instructor should call attention to safety-first signs and symbols found in the posters. New posters should be added often, and the teacher should always devote some time to discussing them. The primary weakness of the poster is
that it serves only as a reminder and does not provide for personal, positive activity on the part of the pupil in the promotion of safety practices and the use of safe techniques.

The motion picture is a very effective aid in the teaching of safety. Although its use has been rather limited, it is becoming increasingly more popular; and its educational possibilities have scarcely been tapped. In a modern program of safety education in the school shop, safety films and sound movies have a real value. They are much better than posters, since they are more appealing and provide for a much greater variety of scenes and ideas; but they should not replace posters, and should be utilized as one phase of the safety-instruction program rather than as the primary phase. Safety films are usually viewed by groups or classes of pupils, thus providing for the development of a common point of view through common appeal and common interests. They should be conscientiously used as aids for instruction and not merely for entertainment. Safety films are now being widely used in industry in shop meetings and employee conferences, and should be accorded a wider use in the safety efforts of industrial-arts and vocational-education shops in secondary schools.

Class trips to various industrial plants, museums of safety, and similar places, are also outstanding visual aids
which can be effectively used in connection with safety education in relation to industrial and vocational classes. Many industrial plants employ safety engineers who educate employees in the value of safety and of safe working conditions and practices. These men are always glad to furnish pupils with first-hand information about safety work as it is conducted in industry.

Visits to safety museums in those cities in which they are operated will acquaint the pupils with many types of safety devices as well as with numerous charts, pictures, posters, films, and slides dealing with safety. A visit to such a museum might well be required of all pupils in vocational classes, and each class could profitably spend some time as a group in visiting such significant centers for safety education.

The day of visual aids is just beginning in secondary education, and the use of these adjuncts to learning presents valuable and inexhaustible possibilities. So far as the use of visual aids in the safety program is concerned, the door of opportunity is open for all who will enter and take advantage of the possibilities therein.

Mechanical Safeguards

As contributions to the general shop program of safety, various types of enclosures or covers may be used to prevent accidental contact with moving parts of machines.
The complete enclosure of all moving belts, pulleys, gears, saws, and other dangerous areas is obviously the ideal. The following practices should be incorporated in the design of the machine or in its operation in the school shop:

1. Enclose all dangerous moving parts.
2. Make conveniently and safely accessible those parts which are subject to wear or which need adjustment and lubrication by hand.
3. Provide automatic lubrication whenever possible.
4. Provide mechanical devices to bring materials to machines and take them away.
5. Remove dust, gases, fumes, and other harmful materials from the working zone automatically.
6. Eliminate noise as far as possible.
7. Eliminate vibration as far as possible.
8. Eliminate such motions of machine parts as may cause eye strain (for example, moving parts that must be viewed through screen or lattice work).
9. Make provision for mounting accessories, such as guards, through bosses cast on the framework and in other possible ways. Use adequate factor of safety.
10. Design the outside shape of the machine so that danger from tripping, falling, and contact will be minimized (rounded corners lessen the danger of injury by collision).31

There is a man-made hazard in every power-driven mechanism. However, this hazard can be reduced, in some cases even eliminated, by a few simple and common-sense rules of operation and by guarding the mechanical hazards to prevent accidental contact with moving parts. Mechanical hazards should be eliminated if there is any practical way to make or provide guards or to redesign or revise equipment to make it safer. Safe operating practices are necessary and should be taught, but they are not substitutes for effective guards.

Usually guards can be designed and installed with greatest facility by the machine builders. Guards so built are an integral part of the machines, and they are likely to fit better and be attached more

31 National Safety Council, Safety Training for Vocational Schools and School Shops, p. 35.
rigidly. The ideal situation is one in which machines are designed and built with complete regard for safety and delivered to the user in as fool-proof condition as possible. Boards of education should be specific in regard to desired guards when ordering machinery. Low bidders are especially likely to deliver machines without guards.32

If the power machines are not adequately safeguarded, it is usually possible for shop classes to construct and install effective guards where they are needed. Once a safeguard has been placed on a machine, it should be against shop rules to operate that machine without the guard. When students are absolutely prohibited from removing safeguards without specific permission from the instructor, fewer accidents may be anticipated. Seeing that safeguards are always in working condition is fully as essential as installing them in the first place, according to the National Safety Council.33 In one of the most valuable discussions of machine guards which the writer discovered, Blake34 accedes

32 Ibid., pp. 31-32. 
33 Ibid., p. 37. 
34 Blake, op. cit., Subject 7, Parts 1, 3, 4, 5, 6, 7.
to this opinion and enthusiastically defends the constant use of all possible mechanical safety devices.

Safeguards which do not interfere with the use of the equipment upon which they are placed are usually considered the safest as well as the most effective. When machine guards have been so designed that they work a hardship upon the operator, curtail production, or are difficult to remove or replace, they are frequently discarded. In most cases, a machine from which a guard has been removed is more dangerous than one which has never been guarded, for the reason that operators quickly and unconsciously form the habit of relying upon guards.35 Unfortunately, mechanical safeguards on machines do not always assure accident prevention. Fully as important as the best of guards is the development of good safety habits and attitudes on the part of every pupil enrolled in shop courses.36

Housekeeping in the School Shop

Shop teachers are judged, more than is generally realized, by their housekeeping. What the supervisors, principals, and parents think of the orderliness or lack of orderliness of the shop may influence to a considerable extent the shop instructor's professional advancement. But that is

35 Welfare Division, Metropolitan Life Insurance Company, Making the Plant Safe, Industrial Safety Series No. 9, pp. 5-12.

a small matter in comparison to
the instructor's influence upon
his students. Many students
must be taught to be good man-
agers if they are ever to become
good managers; and the best way
to teach them is for the shop
teacher to develop the formation
of right habits in his students
through making it a practice to
keep his own shop in shipshape
condition. A good housekeeper
is resourceful with his material,
and a real test in management is
to see what the instructor is
able to do with left-overs. The
convenient arrangement and or-
derly placement of tools when
not in use is one of the most
important phases of good house-
keeping in the shop. There is
no justification for the haphazard placement of tools and
materials, and if no better facilities are available, the
shop teacher can at least see that nails and screws are
inserted in boards or in the wall to provide places for
the convenient accessibility of tools. An orderly toolroom and storage space is important, but it is not indispensable; and the resourceful shop teacher can be orderly in the placement of tools and materials even in the face of a dearth of facilities. Good housekeeping in the school shop, as in the industrial plant, is considered one of the most effective methods of proving that those in charge are interested in the safety of the persons who work in the shop. In addition, it is recognized that a neat, orderly shop not only stimulates carefulness on the part of pupils, but enables all operations to be carried on more efficiently.

Housekeeping is one of the most important factors in accident prevention. Pupils trip over loose objects on the floors; they are hit by tools and materials falling from overhead; they slip on greasy, wet, or dirty floors; they run against projecting, poorly piled or placed materials; improperly piled or supported materials fall on them; and they step on or tear their hands on loose or projecting nails.

Housekeeping is more than cleanliness: it is cleanliness coupled with order. A shop is in order when there are no unnecessary things about, and when those that are necessary


38 Welfare Division, Metropolitan Life Insurance Company, op. cit., p. 12.
are in their proper places. Good housekeeping cannot be maintained by an occasional grand clean-up and setting-in-order. It must be planned for and continually pushed; it must be the imperative daily order in the shop. No shop can be thoroughly efficient and provide a minimum of accident hazards if good housekeeping is practiced only sporadically. 39

Blake, research specialist for the Division of Labor Standards of the United States Department of Labor, has the following to say about good housekeeping in industrial plants, and his statements are equally applicable to school shops:

Housekeeping is such an important part of accident prevention that I always place it first when making a safety inspection. I have never yet seen a dirty, disorderly plant that had a good accident record. I will say further that I have never yet seen a dirty, disorderly plant that was otherwise well managed. Bad housekeeping and good management simply do not exist together. Good safety work is a part of good management and cannot exist with the slovenly sort of management that tolerates bad housekeeping....

If you can get a bad housekeeper really to undertake seriously the job of cleaning up and keeping clean, in the process he will eliminate or reduce a very large part of the accident causes in his plant. When he has his plant in really good order the near elimination of the remaining accident hazards is usually relatively simple. 40

39 Blake, op. cit., Subject 5.

Some workmen, even pupils in school shops, possess the ability to collect odds and ends of materials and storing them away so that they are available when needed. This often saves time, money, and trouble, and is a commendable thing to do when it is done with good judgment. Other workmen, however, surround themselves with a lot of junk and keep it in such a disorderly manner that it becomes a real fire and accident danger. Good salvage work is certainly worthwhile; it not only reduces wastage in materials, but it also has much to do with good housekeeping, and good housekeeping has a lot to do with the prevention of accidents.

Fig. 10. -- No tool has any business on the floor, where it may be a stumbling hazard. Pick it up at once!

In the routine of housekeeping in the school shop, it is advisable to look for such things as cluttered floors; projecting nails in the floor or in projects under construction; slippery floors; obstructed passages;

Fig. 11. -- This is the place for all rubbish -- not the shop floor or the work bench.
hand tools or other objects in hazardous overhead positions; objects and tools and materials that are likely to tip over or fall off of tables or storage platforms; sloppy stacking of materials; materials stacked so as to make exits, safety switches, or fire-fighting equipment inaccessible; and lockers and cabinets piled with an excess of old clothing or other rubbish.41 One of the best discussions that the writer found dealing with the problem of good housekeeping in industry -- which is essentially the same as that in industrial and vocational shops in the school -- is that published by the National Safety Council42 as a "Safe Practices Pamphlet." A similar presentation, though slightly less comprehensive in its scope, is that of the National Conservation Bureau.43

One of the most essential phases of good housekeeping in the shop is to see that the floors are never slippery or cluttered with rubbish, according to the National Safety Council.44 Adequate illumination and ventilation are important as contributing factors to safety in the shop.

41 National Safety Council, Housekeeping, Safety Instruction Cards No. 29, 179.


44 National Safety Council, Industrial Data Sheets, I, 21-22; III, 41-42. See also Blake, op. cit., Subject 8, Parts 1, 2, 3.
Heinrich\textsuperscript{45} has found that if the worker cannot see what he is doing, or if he is made sluggish by impure air in the shop, he cannot do efficient and safe work.

Safety in the Use of Tools and Machines in Woodwork and Metalwork School Shops

General safety.--Hughes,\textsuperscript{46} in a comprehensive investigation of school-shop accidents throughout the United States, discovered that approximately one third of them occurred in industrial-arts shops, whereas approximately two thirds happened in school shops which were more definitely devoted to vocational training. This finding indicates that, on the whole, the industrial-arts shop presents a record of fewer hazards than does the definitely vocational type of shop; but it in no way removes the necessity for caution and safety practices in the industrial-arts shops of the secondary schools. So long as there are any accidents at all occurring there, a need for safety precautions and instruction will exist.

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{image.png}
\caption{Always use a brush to clean chips and other waste from the working parts.}
\end{figure}

\textsuperscript{45}Heinrich, \textit{op. cit.}, pp. 297-301.

\textsuperscript{46}Hughes, \textit{op. cit.}, p. 64.
shop only when they are physically fit and provided with the proper equipment, tools, and safety devices. All unguarded, unsanitary, or otherwise unsafe conditions should be reported to the instructor or to the safety inspector at once. Every pupil should be aware of his responsibility to dress in as safe a manner as possible, to be careful in the use of all tools and machines, to be neat and orderly with all equipment and materials, and to ask for help in the performance of any operation or the use of any machine about which he is uncertain. If every pupil in the shop class is safety-conscious, one can justifiably expect a minimum of accidents and mishaps.

Hand tools. -- Blake,47 the National Safety Council,48 Graman,49 the Pennsylvania Department of Public Instruction,50 the National Conservation Bureau,51 and the Oklahoma Committee on Accident Prevention52 have provided the data from

47Blake, op. cit., Subject 9.


49Graman, op. cit., pp. 18-20.

50Department of Public Instruction (Pennsylvania), op. cit., pp. 13-14.

51National Conservation Bureau, op. cit., pp. 157-158.

52Committee on Accident Prevention (Oklahoma), Accident Prevention in School Shops, pp. 8-9.
which the following discussion of hand tools has been made.

That hand tools account for a large percentage of all accidents in school shops has recently been indicated by Hughes,\textsuperscript{53} who, in tabulating the results of eight comprehensive studies of accidents in school and industrial shops, found that while 1,393 accidents had occurred with machine tools, 3,440 accidents had been reported for hand tools. Hence, in these investigations, hand tools were about twice as high in accident frequency as were machines in the shops. Actually, the number of accidents in connection with the use of hand tools was probably even higher, for so many such accidents are so minor that they never get into the records. The fact that hand tools are used more frequently than machines, and that they cannot be so effectively safeguarded with mechanical devices, helps to account for their high accident frequency.

Care should be taken never to use "mushroomed" tools. The "mushroom" can be removed by a

\textsuperscript{53} Hughes, \textit{op. cit.}, p. 84.
few minutes at the grinding wheel. The proper wrenches should always be used for the job that is being done; many workers have been hurt by using the wrong wrench and losing their balance when it slips. Wrenches should be placed so that each pull forces the jaws onto the nut rather than away from it.

Tools should never be left on the floor where anyone may trip on them. Round tools or round materials on the floor are particularly dangerous, and should always be picked up and put in their proper places.

Many people have been hurt or blinded by leaving the oil can in such a position that they jabbed their faces against the spout.

Tools should always be examined before they are used; they may be dull, "mushroomed," or broken, and, if used when they are imperfect, may cause a waste of time, or even cause an accident. A little time consumed in obtaining a good tool is never time wasted.

Corks or shields should be used to protect the dangerous parts of screwdrivers or other sharp-edged or pointed
tools that must be carried about. These tools should never be carried in the pocket.

Objects being hammered or pounded should be held securely with correctly designed tongs.

Hand tools, when the job is completed or the daily shop period is over, should all be returned to their proper places. There is no excuse for leaving them lying around where they may cause someone to trip or where they may fall and inflict an injury.

Only tools made of non-sparking materials should be used where explosive gases or inflammable materials are present.

Tools should be tempered, dressed, and repaired only by persons qualified to perform such operations.

All tools should be inspected frequently by the tool-room attendants, the safety inspector, the instructor, or some other officially designated competent person, and should be immediately removed from use if found to be defective.
Knives and sharpening steels should be equipped with discs or similar guards which will prevent the hand from slipping against the blade.

**Grinders.** -- This discussion of grinding wheels is based upon data published by the National Safety Council,\(^{54}\) Graman,\(^{55}\) and the National Conservation Bureau.\(^{56}\)

The breaking of the grinding wheel and accidental contact with the wheel while it is in motion are the principal causes of injuries received in the operation of abrasive wheels. All such wheels should be adequately provided with the best protection for the operator that the type of work performed will permit. Where possible, protective hoods should be used. In some cases protective hoods interfere with the work to be done; if this be the case, tapered abrasive wheels with tapered protective flanges may be used. All operators of grinding wheels should be required to wear goggles to

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\(^{54}\)National Safety Council, Gridding Wheels, Safe Practices Pamphlet No. 13; also, Industrial Data Sheets, II, 33-34.

\(^{55}\)Graman, *op. cit.*, pp. 38-47.

\(^{56}\)National Conservation Bureau, *op. cit.*, pp. 119-126.
protect their eyes from flying particles, unless the machines are provided with substantial spark shields. Excessive dust released by the operation of dry grinding wheels is a health hazard and should be effectively removed at the point of origin by an efficient exhaust system.

The authorities previously cited point out the following important factors dealing with the safe and efficient use of grinding wheels:

Vibration often causes damage to the machine or to the wheel. Heavy wheels on light standards are sources of danger because of their unsteadiness. All abrasive wheel machines should be rigidly constructed, sufficiently heavy for the wheels used, and securely mounted on substantial foundations.

Goggles should always be clean and unmarred in any way when grinding work is done. Under no conditions should the eyes go unprotected; a good percentage of eye injuries are due to the belief that small jobs are too insignificant to require the use of goggles.

The operator should always receive instruction and demonstration from a competent person before he undertakes to do any grinding. He should always stand at one side of the grinding wheel when it is starting. If the wheel is defective, it will break in starting up.

The tool rest should be close to the wheel to prevent
a piece from slipping through and catching the operator's hand.

Grinding on the side of the wheel is never considered good practice, because it may result in a serious accident. The operator should keep his hands away from his eyes; it is easy to rub fine particles from hands or face into them. If an emery particle should get into the eye, it should be removed as soon as possible, and only by a competent person, such as an eye specialist, a physician, or a nurse.

Operators of grinding wheels should wear close-fitting clothing. Loose or ragged garments are hazardous.

Saws. -- Publications by the National Safety Council\textsuperscript{57} and the Pennsylvania Department of Public Instruction\textsuperscript{58} were used as principal sources in the writing of this section pertaining to the safe operation of saws.

The principal hazards in the operation of mechanical saws are those of injury to the hands and other parts of the body by contact with the rapidly moving blade, and injury to the operator or other persons through breakage of the saw.

The woodworking band saw is far safer to operate than other woodworking machines such as the circular saw, the

\textsuperscript{57}National Safety Council, \textit{Industrial Data Sheets}, I, 39; II, 8-9; III, 29-30.

\textsuperscript{58}Department of Public Instruction (Pennsylvania), \textit{op. cit.}, pp. 29-32.
shaper, and the jointer. This is due to the fact that the band saw can be more adequately protected than those machines, and also there is no danger of the stock being kicked back toward the operator.

Fig. 17. -- When sawing short pieces, always use a push stick and stand to one side of the saw. Goggles are part of regular equipment.

Fig. 18. -- Keep the guards in place. This band-saw operator wants them exactly right before he starts the saw.

The band saw, as well as all other mechanical saws, should be well anchored to the floor or machine foundation in such a manner as to prevent vibration. The upper and lower wheels of the band saw should be completely enclosed, and the blade should be thoroughly guarded except for a small segment at the point of operation. The blades or
wheels of all other saws should be as completely enclosed as the nature of the work will allow.

Before starting a mechanical saw, the operator should be sure that all safeguards are in place, that the machine is in good working order, and that it is properly oiled.

"Horseplay" in the vicinity of mechanical saws is not to be tolerated. It is decidedly unsafe, as it distracts the operator's attention from his work and is likely to result in serious injury.

When an operator has finished a job, or before he leaves the machine for any reason, he should shut off the power and make sure the machine has stopped running.

Metal saws present the same hazards as those used in woodworking, with the additional one of causing injury to the body, head, or eyes of the operator by flying particles of metal released by the cutting section of the blade. Similar types of guards may be installed to prevent injury.

Wood jointers and buzz planers. -- In the preparation of this material on wood jointers or buzz planers, the writer consulted publications by the National Safety Council,\(^59\) the Pennsylvania Department of Public Instruction,\(^60\) and the Oklahoma Committee on Accident Prevention.\(^61\)


\(^{60}\) Department of Public Instruction (Pennsylvania), *op. cit.*, pp. 30-31.

\(^{61}\) Committee on Accident Prevention (Oklahoma), *op. cit.*, p. 10.
The chief possibility of injury in the operation of wood jointers or buzz planers rests in the chance of injury to the hands or fingers by contact with the rapidly revolving knives in the cutter head. The wood jointer is a dangerous machine to operate unless suitable safeguards are provided and unless the operator is experienced and careful. The danger lies in the fact that under ordinary circumstances, the operator is dependent wholly upon his hands for control of his work. With them he pushes the stock over the knives and keeps it firmly pressed down to secure an even cut; as a result, his hands come in close proximity to the danger point, and the slightest distraction may throw a hand off of the material and into the knives.

The floor about the jointer should be kept free of all obstructions which might present stumbling hazards. Inexperienced pupils should not be allowed to operate the jointer except the instructor be at hand to exercise direct supervision. Before starting his machine, the operator should make sure that the knives are sharp, in
balance, and properly fastened in place; that the guide is set square with the cutter head and securely anchored in that position; that the jointer has been properly oiled; that all guards are in place; and that the jointer and all its parts are in proper working condition. Guards may be obtained for jointers that render them comparatively safe, but not safe enough to warrant the operator in relaxing his vigilance.

Lathes. -- The National Safety Council,62 the Pennsylvania Department of Public Instruction,63 Aiken and Lilly,64 Graman,65 the National Conservation Bureau,66 and the Oklahoma Committee on Accident Prevention67 offer data for the following suggestions for the safe operation of lathes:

In the operation of lathes, the principal hazards are those involved in the possibilities

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63 Department of Public Instruction (Pennsylvania), op. cit., pp. 25-26, 31.
64 C. Aiken and Scott B. Lilly, Teacher Training for Industry, pp. 90-91.
65 Graman, op. cit., pp. 49-64.
67 Committee on Accident Prevention (Oklahoma), op. cit., pp. 11-12.
of bodily injury by flying chips of wood or metal, by the
cutter or the work becoming loose, or by contacts with mov-
ing parts of the machine or of the work being turned.

Lathes are not hazardous if they are adequately safe-
guarded, and if they are operated by persons who know and
follow safe working practices.

All exposed gears, sprockets, and chains should be en-
closed in substantial guards of sheet metal or cast iron.

Pupils should ask the instructor for the proper speed
for each lathe job. All lathe work should be properly set
and solid before it is placed on
the lathe. All wood should be
examined for dangerous knots,
checks, and splits. The work
should be fastened securely,
and all adjustments checked
before the lathe is started.

Neatness is important.
Oil or chips should never be
allowed to accumulate around a
lathe.

Waste, rags, and clothing and hair should always be
kept at a safe distance from moving parts. It is never
safe to grasp the work or parts of the lathe in order to
stop it sooner after the power has been turned off; let
it stop of its own accord.

Fig. 21. -- While he was handling rough
material, he protected
his hands with gloves.
But before he starts
the lathe, he lays the
gloves aside.
Chips are to be removed with a brush, pliers, or a stick of wood, never with the hand. Even though the machine may not be in operation, the hand should not be used. Goggles usually should be worn as a safeguard for the eyes.

No one except the operator should be permitted to handle the starting switches. No one should work on the lathe until he is sure that he understands his machine thoroughly and knows what every wheel, lever, and switch will do.

If guards have been removed, they should be replaced before work is begun on the lathe. The safety guard should remain closed at all times.

Spectators should not be permitted to stand opposite the operator while the lathe is running; a tool or the stock might be thrown and injure them.

Before any job is begun on the lathe, the instructor should always inspect it, check the adjustments and speed, and pass on whether the stock is safe for turning.

Drill presses. -- The National Safety Council, 68 Graman, 69 and the Pennsylvania Department of Public Instruction 70 furnished the data for the following discussion of the safe operation of drill presses.

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70 Department of Public Instruction (Pennsylvania), op. cit., pp. 26-27.
The dangers in the operation of drill presses are those of bodily injury through contact with moving machine parts or tools, through being caught between the work and the machine, through flying chips entering the eyes, and through material falling on the fingers or toes. In all cases, power gears, spindles, sprockets, and chains should be enclosed in cast iron or sheet metal guards to prevent injury by accidental contact.

Operators should always wear goggles to prevent chips and other flying particles from entering their eyes. Operators should not attempt to drill material unless it is held in a drill-press vise or clamped to the table, or held in some other safe manner which will prevent the work from being whirled about by the revolving drill.

If the work slips in the vise, or because the clamp holding it has become loose, the operator should not attempt to hold the work with his hands or try to tighten the vise or clamp while the machine is in motion. He should shut off the power and then tighten the vise or clamp securely before restarting the machine.

Fig. 22. -- If the work is firmly clamped on the table, the drill press can be operated with confidence and safety.
The operator should never place his fingers under the work to determine whether the drill is coming through.

The safety guards should always be employed to hold the work or the vise securely in position.

Shapers and planers. — The National Safety Council,\textsuperscript{71} the Pennsylvania Department of Public Instruction,\textsuperscript{72} Graman,\textsuperscript{73} Aiken and Lilly,\textsuperscript{74} and the Oklahoma Committee on Accident Prevention\textsuperscript{75} are the sources for the following data on the operation of shapers and planers:

In the case of shapers and planers, the principal hazards are those of injury through bodily contact with the knives, or with splinters thrown by the knives, or knives being thrown from the shaper head. The wood shaper is one of the most dangerous of the woodworking machines because of the high speed at which the knives revolve and the fact that in most cases the work is fed by hand past the knives. Wood shapers should be of heavy, rigid construction, with all vibration and chatter eliminated.

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\textsuperscript{71}National Safety Council, Industrial Data Sheets, I, 30-31; II, 29-30, 35-36.

\textsuperscript{72}Department of Public Instruction (Pennsylvania), \textit{op. cit.}, pp. 27-28, 32.

\textsuperscript{73}Graman, \textit{op. cit.}, pp. 76-78.

\textsuperscript{74}Aiken and Lilly, \textit{op. cit.}, p. 91.

\textsuperscript{75}Committee on Accident Prevention (Oklahoma), \textit{op. cit.}, p. 91.
The floor around each shaper should be made of or covered with non-slip material. Wherever the nature of the work permits their use, cylindrical cutting heads should be installed.

The cutting head of each wood shaper should be provided with a guard which will keep the operator's fingers away from the cutting edges of the knives. Wood-shaper work is of such variety that a universal guard cannot be used for all operations, but at all times some effective safeguard should be utilized to protect the operator from the revolving knives.

The use of exhaust hoods is highly advisable, so that the table may be kept clean of shavings and objects that may be thrown out by the knives. It is desirable to have adjustable hoods so that they may be swung around and thus be effective for any of the various kinds of cutting that may be done on the machine. Hoods should be made with a wide flat side that will lie on the table top. If the work will permit, clamps and guides should be used to enable the operator...
to feed the material to the knives without danger to his hands.

The operator should be careful at all times to place himself in such a position that there is no chance of his being caught between the cross-rail, the ram, the housing, and the work. He should also avoid placing himself in a position that would permit him to be caught between the platen and the bed.

All loose tools and other objects should be removed from the planer before a cut is started. A brush should be used at all times to remove chips or shavings. One should never reach for any tool as the planer bed runs back and forth; many persons have been injured in that way.

The stops should be carefully set for controlling the movement of the table, as there otherwise is danger that the table will run off of the bed. Extra care should be taken that all clamps are tight on the work while the machine is running.

Goggles should be worn at all times when operating a shaper or planer. The instructor should always inspect the work, the security of its position, the adjustment of the machine, etc., before the pupil begins the operation of shaping.
First Aid in School Shops

Practical and comprehensive discussions of first aid for the school and the school shop are provided by the National Bureau of Casualty and Surety Underwriters,76 the Michigan State Board of Control for Vocational Education,77 Heinrich,78 the National Conservation Bureau,79 the Metropolitan Life Insurance Company,80 and Matthews, Risinger, and Wilson.81

A careful record of all accidents that occur in the school shop should be kept, because the possibility of serious injury is often only a matter of chance. The factors connected with minor injuries are often the same as or similar to those resulting in major injuries. Descriptions of near-injury accidents may be highly valuable in bringing


78 Heinrich, op. cit., pp. 322-327.


80 Metropolitan Life Insurance Company, First Aid.

81 J. C. Matthews, Joe L. Risinger, and Jimmie Wilson, Safely on We Go, pp. 187-268.
accident causes to light and in making their correction possible before serious injury results.\textsuperscript{82}

A large insurance company has estimated that for every shop accident requiring professional medical attention, there are twenty-nine injuries requiring only first-aid treatment. Also, for every first-aid accident, there are ten no-injury accidents.\textsuperscript{83} Hence, for every accident reported to a doctor, there are twenty-nine first-aid cases and approximately three hundred no-injury accident cases. These findings point out a golden opportunity to discover and correct causes before injury results. But which accident in the three hundred will produce the serious injury cannot be foretold.

First-aid treatment should be administered as soon as possible after an accident occurs, no matter how trivial the injury may appear. For more serious cases, first aid is merely emergency treatment, designed to assist in placing the injured person under competent medical care with the least possible danger of added injury, infection, or discomfort. Unqualified persons should not attempt to perform minor surgery or try to treat infected wounds. Immediate first-aid treatment sometimes saves a person's life, and in

\textsuperscript{82}National Safety Council, \textit{Safety Training for Vocational Schools and School Shops}, pp. 16-17.

\textsuperscript{83}\textit{Ibid.}, p. 16.
all cases it reduces suffering and places the patient in a
doctor’s hands in a better condition for effective treat-
ment.

All cases of injury should be referred at once to the
school nurse, if one is available. If no nurse is employed,
other persons with a knowledge of first aid should be called
upon. Every shop class should have at least one qualified
person present at all times. It is recommended that the
shop teacher be familiar with
the fundamentals of first aid,
and be capable of looking after
such injuries as may occur in
his shop. If an injury is se-
vere and the victim is suffering
from shock, from broken bones,
or from severe bleeding, moving
him may be very dangerous; and
a doctor should be summoned to
the spot immediately. Even if a school nurse or other pro-
fessional attendant is available in the school, every shop
should be equipped with a well-stocked first-aid cabinet
for use in emergencies.84

Many pupils possess the mistaken notion that because
they are well and strong, they should pay no attention to

84Ibid., pp. 16-18, 28.
little cuts and scratches. It may seem silly to stop work for such small injuries. But no matter how healthy one is, he cannot afford to take chances with infection. The small wound may be unimportant at first, but delay in caring for it may make it serious. Every pupil should recognize the fact that he should stop what he is doing long enough to get the right kind of first-aid treatment.

No pupil should touch an open wound, or wash it out, or use a rag to wrap it up; a little bleeding helps to flush out harmful germs. An open wound should never be covered with adhesive tape. A wound should not be sucked, except perhaps in rare cases of snake bite or dog bite. Blisters should not be broken. No one but a physician or a qualified nurse should be permitted to remove foreign particles from the eye. Pupils should never use a knife or a pin to remove splinters -- the nurse or the doctor can do this in a safe and efficient manner.\textsuperscript{85}

\textsuperscript{85}National Safety Council, \textit{First Aid for Every Minor Injury}, Safety Instruction Card No. 233.
CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

As a result of this investigation, the writer feels warranted in formulating several general conclusions and in making certain recommendations with relation to a program of safety in the shops of secondary schools.

Conclusions

In the world of today, with its complex industrial organization in which men and women are in daily contact with powerful and dangerous machines, accidents are to be expected. They can, however, be held to an absolute minimum if constant caution is exercised by the worker, and if the environment in which he works is as "accident-proof" as it is mechanically and physically possible to make it. It is the purpose of safety education in industry and in the school to prepare workers for assuming responsibility in industry in a safe and efficient manner.

In any program of safety instruction, the so-called "three E's of safety" -- education, engineering, and enforcement -- are significant and should be given a substantial role in the effort to develop safety consciousness.
The first efforts at safety promotion were begun in industrial plants, for industry soon learned that no employee can be an efficient worker unless he is also a safe worker. Industry began to insist that the educational system do something to prepare pupils for the safe performance of jobs in the plant. Consequently, schools initiated an emphasis upon safety which is growing increasingly important in the educational program. In the industrial-arts and vocational-education shops of the schools, pupils could become acquainted with safety habits, attitudes, and practices that would be readily utilized in the industrial world. The school is becoming increasingly aware of its responsibility to provide industry with workers who will be safe and efficient in the performance of their work.

Although ingenious mechanical safeguards are available for all dangerous machines that are used in the school shop and in industry, these safeguards cannot remove the need for caution on the part of the worker. No machine can be made "accident-proof" in the face of carelessness, negligence, or inattention.

In the safety program of the school shop, the instructor plays an important role as guide, manager, supervisor, and trainer. He must scrupulously practice all the safety rules himself if he is to develop safety consciousness in his pupils. The most effective organization for a school-shop safety program is one in which the pupils themselves
assume the responsibility for discovering hazards, unsafe practices, and careless procedures, and take it upon themselves to remedy the conditions and practices that are unsafe. All this should be done, of course, under the immediate supervision of the shop instructor.

Through visual aids -- including motion pictures, slides, and posters -- safety instruction can be made more meaningful to pupils, for these methods can be made to supplement and to drive home the lessons that the teacher is able to bring to the class through demonstration and example.

Good housekeeping in the school shop implies both universal cleanliness and the orderly arrangement of all tools and materials. A shop which is dirty and disorderly presents many accident hazards which are unknown in one where good housekeeping habits are in evidence.

A well-stocked first-aid cabinet is an essential in every school shop, and the immediate use of first-aid treatment serves to mitigate the results of such accidents as may occur as the pupils go about their work.

Recommendations

**Shop organization for safety.** -- Every industrial-arts shop class should have a pupil organization for safety, such as a safety committee or a safety council, set up in such a way that every pupil in the class will have an opportunity to serve on the council or committee during the semester or
term. The instructor, of course, should be the general supervisor of the activities of such a pupil organization, and should be an ex officio member with advisory and counseling powers. The safety organization should have regularly scheduled meetings for the purpose of discussing safety conditions in the shop and of doing something about those conditions which are deemed hazardous. Hughes,¹ after a comprehensive investigation of safety conditions and practices in secondary schools and colleges throughout the nation, recommends the use in every school shop of the safety-committee organization as one of the most effective means of educating pupils for safety, of discovering unsafe situations and practices in the shop, and of remedying the hazards that are present.

One member of the shop safety council should be the safety inspector, analogous to the safety foreman or the safety engineer in industrial plants. He should wear a badge or pin denoting his position, and should receive the cooperation and respect of every member of the class. He is to be responsible for regular (at least weekly) inspections of the shop, its machines and tools, its storerooms, its rubbish containers, its electrical installations, and its safety bulletin board. Every day he is to be on the lookout for unsafe conditions, improper clothing, faulty

¹Hughes, op. cit., pp. 338-339.
tools and machines, and working habits that are conducive to carelessness, accident, or recklessness. Upon discovering such hazardous conditions, he should point them out immediately to the instructor and to all the pupils affected by them. If the conditions cannot be corrected at once, he is to see to it that pupils remain away from the danger zone until the hazard is removed or corrected. All of the findings of the safety inspector are to be reported to the safety council, together with recommendations for action.

In the interest of shop safety, it is important that the industrial-arts instructor be familiar with safe practices and be firm in his demands that they be carried out at all times. If he is disinterested or indifferent, his pupils cannot be expected to develop a wholesome safety consciousness such as should be the objective of every school-shop class. To relieve the instructor of clerical duties so that he may have more time to serve as a supervisor of the shop projects, a shop secretary for each class is recommended. This person must be an efficient, reliable pupil whose duties will consist of keeping all class records, including those dealing with attendance, absence, bills for materials, permission forms for the operation of machinery, report forms for all accidents occurring in the shop, etc. He should collect all notebooks, reports, and other related material as it comes due, submitting it to the instructor. He should also keep on file all the reports of
the safety inspector, recommendations for the elimination of safety hazards, and written records of all activities and decisions of the safety council.

Another vital person in the shop organization for safety is the maintenance foreman, who serves as the assistant to the instructor. He is to help any boy requiring assistance or individual attention in his construction activities in the shop, and for this reason will not himself be able to complete as many construction projects as the other members of the class. He is directly responsible to the safety inspector for maintaining neatness and orderliness in the care of tools and equipment and the cleaning up of the shop. In the latter activity, he should follow the clean-up schedule prepared by the safety inspector, which should always be posted on the bulletin board. Every boy must know his clean-up assignment, and the maintenance foreman sees that every boy under his supervision knows how to perform his share of the responsibility. When the clean-up signal sounds, the maintenance foreman should be the first to place his project and tools in their proper places of storage and to brush off the top of his table or bench; then he should go here and there throughout the shop to supervise the other clean-up tasks, giving assistance when needed, and commending pupils when their task is exceptionally well performed. The maintenance foreman is graded
each day on two qualities — cooperation and efficiency. His grade on cooperation is based upon his ability to get along with his group, and upon his willingness to leave his own job when necessary to offer assistance to someone else. His grade in efficiency will be based upon his ability to keep boys in his group working safely and industriously during the shop period and to engage in effective clean-up activities at the close of the period.²

In the woodshop, the lumber-room foreman is an important member of the class. He assists any boy requiring help or individual attention in the selection and obtaining of lumber from the lumber storage room. He is directly responsible to the instructor and to the safety council for the method and manner of storing and stacking lumber, caring for the tools and materials used in the lumber room, and the general neat and orderly appearance of the lumber room. His first responsibility is to learn how to store lumber to prevent its warping and twisting. He should learn also what types of lumber are suitable for specific construction jobs, and those which are unsafe for certain projects or for use with certain machines.³

The finishing-room foreman should be placed in charge of the finishing room, where projects are taken to be finished. He assists the pupils in selecting or obtaining necessary finishing materials from the finishing-room, and

²John F. Heikkila, Shop Organization for Industrial Arts Classes, pp. 30-32.
³Ibid., pp. 33-35.
offers help in applying the various finishes. In the finishing room, he is responsible for the neat and orderly arrangement of all finishing materials, brushes, and projects in the process of being finished. He should instruct the pupils in the proper care of brushes and other devices for applying the finish to their projects, and see that they make proper disposal of waste materials, oily rags, varnish-stained paper towels, etc. He is never to allow any accumulation of materials or rubbish which might possibly present a fire hazard.  

The "three E's of safety." -- Every school-shop program for the prevention of accidents and the safe performance of work should take due consideration of the so-called "three E's of safety" -- engineering, education, and enforcement -- without which no safety effort can be successful.  

Engineering should properly be taken into account in the architectural planning of the school building and the shop quarters; but if safety has not been given a proper role in the construction of the plant, certain engineering factors can still be considered and applied at little cost or effort. Once a building has been erected, it is seldom a wise policy to reconstruct any part of it for the sake of greater safety. By working with the existing plant, however, the safety-conscious shop instructor and the shop

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4Ibid., pp. 36-39.
5Bacon, op. cit., pp. 70-73.
safety council can still incorporate certain safe principles of safety engineering. Included in these are the lighting and ventilation of the shop; the care of floors and stairways to prevent slipping hazards; the placement of machinery and tools; the provision of proper storage space for materials, tools, and rubbish; the installation of mechanical safeguards at all points of contact and points of operation on hazardous machines; the proper enclosure of all bolts, pulleys, and gears; the regulation of the size of classes so that the shop will provide at least forty square feet of floor space per pupil.

The educational phase of safety instruction should have for its goal the thorough development in all pupils of all "the knowledges, ideals, and attitudes which are considered essential to enhancing their chances for avoiding accident, not only in the school shops, but also during their career in the trade for which the school had prepared them."\textsuperscript{6}

Today the school is primarily responsible for the development of the knowledges, the attitudes, the habits, and the skills which are necessary if people are to be enabled to live in the modern world with a reasonable degree of safety. In the performance of this function, safety education is substantial and positive, not negative; and, since the field of safety is an adventure within itself, what safety

\textsuperscript{6}Henig, op. cit., p. 102.
education does is to substitute a good adventure for a poor one. It is impossible for one to "live dangerously" unless he is first prepared to "live safely," and the only way in which one can sensibly face "fearful odds" is on a basis of safety.  

Howard, in an investigation of safety and accident prevention in school shops and in industry, found that:

Methods for giving safety instruction vary exceedingly. Experience, knowledge, and point of view of the instructors are all factors which largely determine how efficiently safety is taught. Some shop instructors resort entirely to posters placed near each machine for pointing out to the boy the safety precautions to be observed in operating that particular machine. Others give definite instruction and use posters only as reminders. Group instruction is sometimes used, but it is conceded that individual instruction is the better of the two ways of imparting safety knowledge to pupils.  

"Education means fulfilling the need for information and training in safety. The vast majority of pupils desire to work safely, to abide by the rules, and to prevent accidents. They cannot know how to do it until safety principles and rules are brought to their attention and safety habits are developed by means of instruction and adequate demonstration."

7 American Association of School Administrators, op. cit., pp. 9, 18, 21.

Education for safety should be an integrated, continuously operative part of the curriculum of the school shop; it should not be taught in concentrated form as a unit and thereafter looked upon with more or less indifference, but instead it should be applied to the performance of every shop activity so that the pupil will be conscious of the function of safety in every job he undertakes. Safety practices that are not operative on the job when and where they are needed are worthless. The teacher, of course, must be thoroughly grounded in the principles of safety before he can be successful in educating his pupils for safety in the shop, in life, and in industry. Hughes recommends that all teacher-training institutions offer a required course in shop safety for all prospective industrial-arts teachers.

In addition to individual instruction, group instruction, demonstration, and example, visual aids should be utilized widely throughout the school-shop safety program. Movies, slides, charts, and posters hold many possibilities for the graphic presentation of safety hazards and safe practices; and they are highly valuable instruments in the development of safety concepts.

The enforcement angle of the school-shop safety program is dependent largely upon the instructor and the shop safety council, upheld, of course, by the administration of the

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8Hughes, op. cit., pp. 333-334.
school. The instructor should know the rules of safety, and he should be firm in his demands that they be observed by every pupil at all times. A well-organized and efficient pupil safety organization is recommended as one of the best ways to "sell" safety to pupils. The feeling of responsibility which such an organization engenders in the pupils often accomplishes more in the line of safety education than the instructor can possibly achieve. If the pupils can be made to feel that they are personally responsible for safety in the shop, they will not often be found wanting in their diligence.

Housekeeping in the school shop. -- Hughes\textsuperscript{10} found that many shop accidents in the secondary school are caused, in part at least, by poor housekeeping conditions. He feels that there is no justification in any circumstance for permitting a shop to become disorderly and cluttered up with rubbish, scraps of material, and scattered tools. The convenient arrangement and orderly placement of tools when not in use is one of the most important phases of good housekeeping in the shop. Even a small shop with poor facilities for storage can be made neat, orderly, and convenient by the exertion of a little effort and the use of nails and screws to provide places for the arrangement of tools and materials in an orderly fashion. Good housekeeping in the

\textsuperscript{10}Ibid., pp. 164, 343.
shop, as in the industrial plant, is considered one of the most effective ways of proving that those in charge are interested in the safety of the persons who work in the shop. In addition, it is recognized that a neat, orderly shop not only stimulates carefulness on the part of pupils, but enables all operations to be carried on more efficiently.\textsuperscript{11}

Good housekeeping cannot be maintained by an occasional grand clean-up and setting-in-order. It must be definitely planned for and continually emphasized; it must be the imperotive daily order in the shop. No shop can be thoroughly efficient and provide a minimum of accident hazards if good housekeeping is practiced only sporadically.\textsuperscript{12} Good housekeeping is more than cleanliness; it is cleanliness coupled with order. A shop is in order when there are no unnecessary things about, and when those that are necessary are in their proper places. Everything that is conducive to the more efficient and convenient performance of work is at the same time conducive to safety in the school shop. It is recommended, therefore, that good housekeeping practices be utilized at all times in order to insure neatness, cleanliness, and order.

\textit{Hazardous hand tools}. -- In the extensive survey conducted by Hughes,\textsuperscript{13} he found that the number of accidents

\textsuperscript{11}\textit{Welfare Division, Metropolitan Life Insurance Company, op. cit., p. 13.}

\textsuperscript{12}\textit{Blake, op. cit., Subject 5.}

\textsuperscript{13}\textit{Hughes, op. cit., p. 84.}
reported from the use of hand tools in school shops was prac-
tically twice as high as the number of accidents reported
for machine tools. It is possible, furthermore, that the
actual number of accidents involving the use of hand tools
is higher than the reported number indicates, since many
of such mishaps are of a minor nature and never get into
the records. Of all the various hand tools common to the
school shop, it appears that the chisel is by far the most
dangerous to use, since the frequency of accidents for this
tool was found by Hughes\textsuperscript{14} to be as high as that for all
other hand tools combined. Other hazardous hand tools, ac-
cording to his report, are the saw, the knife, the hammer,
and the plane.

The fact that the above-named hand tools continue to
have unusually high accident-frequency records indicates
the possibility of deficiencies in instruction as to the
safe use of such tools. Shop instructors should exercise
greater caution in their supervisory activities and in
their instructional techniques, to the end that no pupil
will be allowed to use a hand tool or to operate a machine
tool until he has proved his ability, under supervision, to
use or operate it safely.

Hand tools should always be used in such a way that if
they should slip, they cannot injure the hand or the body.

\textsuperscript{14}\textit{Tbid.}, p. 76.
Tools should always be examined before they are used; they may be dull, "mushroomed," or broken, and, if used when they are in an imperfect condition, they may cause a waste of time or an accident. The right tool should always be used for the job to be done; makeshifts should never be employed.\textsuperscript{15}

Chisels that are "burred" or hammers that are "mushroomed" should never be used. If the chisel is not properly tempered for the job, or if it is defective in any other way, it should be returned to the toolroom and exchanged for one in good condition. When using a chisel, the worker should wear goggles to protect himself from flying particles. Suitable screens should be set up to protect other persons from flying chips. Two persons who are chipping on the same material should work back to back. The safest way to hold a chisel is between the thumb and forefinger, palm up. If the chisel is gripped in the fist and a blow misses the chisel head, painful and sometimes permanent injuries are almost sure to result to the knuckles and hands. When one's hands are numb with cold, he should never attempt to hold a chisel, especially if someone else is wielding the hammer or sledge.\textsuperscript{16}

\textsuperscript{15}National Safety Council, \textit{Hand Tools}, Safety Instruction Card No. 85.

\textsuperscript{16}National Safety Council, \textit{Cold Chisel Cautions}, Safety Instruction Card No. 483.
No hammer should be used until it has been examined to make sure the head is securely fastened to the handle, and that neither the head nor the handle is chipped or broken. The hammer should always be kept free from all grease and oil, which might cause it to slip from the grasp or to glance from an object being struck. The handle of the hammer should be grasped firmly near the end, the eye should be kept on the point to be struck, and true blows should be struck. Care should always be exercised that no hammer is left lying overhead; it might fall and injure someone. When driving a nail with a hammer, the thumb and fingers should grasp the nail near its head so that, if the nail slips or the hammer misses the head, the thumb and fingers are knocked out of the way and escape being mashed. ¹⁷

Screwdrivers which have split or splintery handles should never be used. An auger, a drill, a boring bit, or a driven nail should be used to start each screw; otherwise the screw will have to be guided with the fingers in a dangerous position. If the point of the screwdriver is badly worn, it should be put in good shape before it is used. Screwdrivers should never be used as substitutes for punches, chisels, nail pullers, etc. ¹⁸

Such sharp tools as files, screwdrivers, bits, and

¹⁷National Safety Council, Hand Hammer Hints, Safety Instruction Cards No. 31, 153.

¹⁸National Safety Council, Screw Driver, Safety Instruction Card No. 257.
chisels should be carried in a horizontal position in the
croach of the arm to avoid the danger of injury to the body
in falling, tripping, or having the attention distracted.
Such tools should never be carried in the pockets of the
trousers, the shirt, or the jacket. Files should always
have firm, substantial handles. They should never be hit
with a hammer, since pieces of the hardened steel are
likely to fly. Files are not to be used as punches or
chisels; they are too brittle for these purposes, and for
the same reason are dangerous when used as prying tools.19

Hazardous machine tools for the woodshop. -- Among the
most dangerous machines found in the school woodshop are
the various types of saws, such as the circular saw, the
band saw, the rip saw, and the scroll saw. None of these
saws should be operated by any pupil who has not first demons-
trated to the instructor that he understands how to use
the particular machine; and even then, the saw should not
be started until all its adjustments have been checked
and all its guards are properly in place. While a saw is
in operation, conversation between the operator and any-
one else except the instructor should be prohibited. All
portions of the blades of all these saws should be ade-
quately safeguarded except the point of operation, and
such guards as are possible should be utilized here to

19National Safety Council, Files, Safety Instruction
Card No. 174.
prevent the hands of the operator from being endangered. Care should be exercised to prevent the use of wood which has flaws such as knots. It should be remembered that accidents in the operation of mechanical saws are largely caused by carelessness and by taking a chance. The danger of taking chances should be repeatedly pointed out by the instructor, and class disapproval of chance-taking should be so strong as thoroughly to discourage the practice.

Jointers are among the most dangerous machines in the woodshop. Every hand-feed jointer should have an automatic guard to cover the section of the head next to the operator, and another to cover the section of the head back of the gauge. Here, also, accidents are largely due to carelessness or chance-taking. The operator should not converse with anyone while working at his machine. At all times he should keep his fingers away from the blades, and should use a push block for feeding short stock over the jointer knives. The greatest care must be observed that no gloves, ragged or loose clothing is worn when operating the jointer.

Operators of lathes should not be distracted by conversing with another person. If the lathes are belted, the shifting of belts must be done with a belt shifter and never with the hands. The job should always be set firmly between centers, or securely fastened to the faceplate, as the case may be, before the power is turned on. Loose, ragged clothing or gloves should not be worn by lathe operators; loose
or hanging neckties are a common hazard. Short-handled tools, or tools without handles, should not be used. When large work is being done, the lathe should never be run rapidly.

Mortising machines must be provided with thumb stops to prevent the hands of the operator from coming in contact with the chisels. Safety bit chucks with no projecting set screws should be used. snug clothing is important. All guards must be securely in place and workable before the machine is started, and all boring bits and chisels must be in good condition before they are used. All dust and wood particles should be removed from the table or from the work with a brush, never with the hands; the floor should be kept free of accumulated stock and all other materials that might constitute a stumbling hazard.²⁰

Disc sanders and belt sanders should have the periphery and the back of the revolving head thoroughly guarded, and an approved exhaust system should be provided for the removal of dust.

Hazardous machine tools for the metalshop. -- One of the most common hazardous machines in the metalshop is the lathe, for which practically the same safety rules apply as for the wood lathe. In the case of this machine, the pupil should have thorough instruction as to its operation and understand how to use every part of the machine before

²⁰National Safety Council, Wood Boring Machines, Safety Instruction Card No. 473.
being allowed to operate it. His first operative attempt should be conducted under the personal direction and supervision of the instructor or some other competent person.

Loose clothing should never be worn and rags should never be used around the swiftly revolving drill of the drill press. All work should be securely clamped to the table or held firmly in a jig or chuck. When the work is held by hand, an accident is likely to occur if the drill should stick or catch, as it often does. The drill should never be forced by exerting too much pressure on the feed lever or by running at too high speed. Many drills break under such strains, and flying pieces may injure others as well as the operator. The drill should be fed slowly and cautiously, particularly when it is breaking through the stock, to prevent throwing the stock. If the work should become loosened from the clamps and begin turning around on the revolving drill, the power should be shut off immediately, with no effort to stop the work from revolving until the machine has come to a standstill.

In operations requiring the use of emery wheels or grinding stones, there is danger from flying particles. Pupils should always wear goggles or other suitable protection to prevent injury to the eyes. The grinding wheel should be completely enclosed except at the point of operation,
where glass shields should be installed to prevent particles of dust from flying into the face of the operator. Grinding the edge of thin or narrow-gauge metal is dangerous, as friction tends to turn the edge of the metal over and drag the operator's hand into the machine. The tool rest should always be carefully adjusted for the particular job to be done, and it should be made secure before the grinder is started. Grinding on the side of thin wheels and attempting to make adjustments while the wheel is running are responsible for many accidents.

Revolving shafting, although apparently smooth, is rough enough to catch loose articles, such as neckties, ragged sleeves, waste, rags, etc. Proper clothing and caution are always necessary when working around any revolving machinery.

First aid. — Every school shop should have a well-stocked first-aid cabinet accessible at all times. Some member of every class should be familiar with the fundamentals of first aid so that he may give assistance in case of emergency or accident. It is recommended that the shop instructor know first-aid procedures and be able to administer such first-aid treatment as the shop situation may require. It is further recommended that each shop class have a "student doctor," who will either administer treatment himself or serve as assistant to the instructor or anyone else qualified to act in case of an accident.
Every accident, no matter how trivial, should receive immediate treatment. Much suffering and sometimes permanent injury can be eliminated by the immediate and careful administration of first-aid treatment.

Checklist for the evaluation of the safety program. — The writer recommends that shop teachers utilize the following checklist at least once a month as a means of determining the status of the safety-education program of the school. School administrators may likewise find profit in the frequent use of this checklist, prepared by the National Education Association. 21 In checking, each item is to be answered "Yes" or "No."

1. Are activities in all rooms continuously and adequately supervised?
2. Are conspicuous notices of possible hazards, safeguards, and first aids posted in these rooms?
3. Are life and limb safeguarded by:
   Careful housekeeping?
   The installation of screens and guards around hazardous equipment?
   The approved installation of all machinery?
   The installation of safety switches on all machinery?
4. Are students and teachers required to wear necessary protective devices, such as gloves, goggles, and aprons?
5. Are all special shops and laboratories equipped with a standard first-aid kit?
6. Is first aid immediately available and promptly rendered by a competent person?
7. Are pupils required to pass tests in safety rules?
8. Are initial activities of each pupil, in connection with power or other hazardous equipment, permitted only after adequate instruction and under direct supervision of the teacher?

21 Checklist adapted from Checklist of Safety and Safety Education, pp. 18-19, 21-24, prepared by the Research Division of the National Education Association.
9. Do those in charge of these various activities make a periodic check-up, using a safety checklist to aid them?

10. Do those in charge of these activities regularly report to the principal concerning safety conditions?

11. Is every effort made to have hazardous conditions immediately corrected?

12. Have the shops been inspected by a representative of the State Industrial Accident Commission or other authoritative agency?

13. If recommendations were made by such a representative, were they adopted?

14. Has safety education been made a definite and important part of the educational program in the school?

15. Has anyone in the school been appointed as chairman or director of safety education?

16. Are teachers provided with a course of study bulletin in safety education?

17. Are conferences, discussions, and demonstrations arranged to assist teachers with safety instruction?

18. Are teachers encouraged to attend classes in safety education conducted at teachers colleges, universities, and normal schools, or helped by an in-service training program of the school system?

19. Does the instruction provide well-planned units in all aspects of safety -- school, home, highway, recreational, and occupational?

20. Are special courses offered in:
   Lifesaving?
   First aid?
   Driver education (classroom instruction on the motor car)?
   Driver training (actual road experience)?

21. Is specific teaching of safety in physical, workshop, and laboratory activities included in the instructional program?

22. Is instruction in safety presented with the following objectives in mind:
   To help children recognize situations involving hazards?
   To develop habits of conduct which will enable children to meet situations of daily life with as little danger as possible to self and others?
   To develop habits of carefulness and obedience to safety rules, wherever one may be -- at home, on the streets, in school, or at play?
To teach children to read, understand, and obey safety rules and regulations?
To develop habits of orderliness and carefulness in the use of playthings, tools, common articles of the home and school, and in the use of fire?
To teach children to cooperate to prevent accidents and the taking of unnecessary risks involving physical dangers?
To develop wholesome attitudes concerning (a) law and law enforcement officers, (b) the safety of self and others, and (c) organized efforts to assure safety for all?
To give children actual experiences in desirable safety practices?

23. Are the following methods and devices used in the safety instruction programs?
   Pupil discussions directly related to use of equipment and materials in various classes?
   Motion pictures on safety topics?
   Dramatizations of safety lessons?
   Supplementary readers on safety?
   Film pictures and posters?
   Pupil organizations, such as safety councils, traffic patrols, and safety committees?
   Talks by policemen, firemen, and other specialists?

24. Is an effort made to guide children in choosing safety-conscious pupil leaders?

25. Are classes frequently dismissed with a safety thought?

26. Does your school have the safety publications prepared by the National Education Association and the National Safety Council?

27. Does the school library have interesting and attractive books on all phases of safety?

28. Does the school library subscribe to at least one monthly safety magazine?

29. Is "safety" or some phase of it used as the theme for assemblies, bulletin boards, compositions, poems, scrapbooks, and posters?

30. Does the school newspaper devote special issues or space in regular issues to safety news?

31. Does your school or the school shops sponsor their own safety contests?

32. Is there a pupil safety club in your school?

33. Do the textbooks (e.g., reading, science, social studies) contain material on safety?
34. Are accident statistics used for study in your safety education program?
35. Are safety posters placed on bulletin boards and in other conspicuous places?
36. Do teachers know the sources from which varied types of safety materials may be procured?
37. Has the principal or the shop instructor asked the following sources for safety aids:
   Local school officers and staff?
   State education department?
   National safety organizations?
   Automobile clubs?
   Insurance companies?

Recommendations for further study. -- The writer, during the process of this investigation, was surprised to find that comparatively little research has been done in the field of safety education in schools. An overabundance of material is available on safety programs in industry, but what the schools have done or should do seems not to have challenged investigators to the degree warranted by the importance of the subject. Therefore the writer recommends that further study be made along the following lines:

1. Prerequisites to safety training.
2. Identification, availability, and use of teaching materials in the field of school and shop safety.
4. Development of a comprehensive course of study for safety training in all phases of school life.
5. Evaluation of school safety programs in the light of industrial demands.
6. Visual aids in the safety program of the school.
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