A Study of the Boston Mechanic Arts High School

Being a Report to the Boston School Committee

BY

C. A. PROSSER

SECRETARY, NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE FACULTY OF PHILOSOPHY, COLUMBIA UNIVERSITY

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CONTENTS

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FOREWORD

1. *Reasons for the report.*—This report presents the results of a study of the Mechanic Arts High School undertaken at the request of the Boston School Committee. Its aim has been to determine to what extent the school is effectively performing in the school system the purpose intended by the committee of preparing boys for advantageous entrance to industry on the business and directive side. With the wisdom of that purpose this report has nothing to do.

Owing largely to the rapid development of industrial education in Massachusetts during the past few years and a changing conception of the purpose and place of manual training, the aim of the Mechanic Arts High School has of late frequently been called in question and several investigations have been made with a view to determining just what kind of service the school ought to render the city of Boston and how that service can best be performed. The first of these studies was made by Mr. Arthur L. Williston, director of Wentworth Institute, and the second by the business men's advisory committee for the school, consisting of Messrs. Fish, Alexander, Burton, Lindall, Green, Ziegler, Russell, and Kaven. The findings and recommendations of this present report are compared with those of the two previous studies.

2. *Scope of the report.*—This report is concerned with these two questions: (1) How far is the school now effectively accomplishing the purpose of the school committee, and (2) what changes, if any, should be made in the work of the school in order that it may better accomplish this purpose.

3. *Spirit of the report.*—It should be understood at the outset that this investigation has been undertaken in no hostile

spirit and that this report is not intended as an indictment of the headmaster and the faculty of the school, or a criticism in general of their efficiency.

The Mechanic Arts High School was organized in 1892 as a manual training high school. An early report of the committee in charge of the school indicates that they believed it should be a fundamental purpose of the institution to serve as a high school offering systematic instruction in the mechanic arts and drawing, and that preparation for the engineering college was also a legitimate part of its work. This policy has been consistently followed since the founding of the school and until recent years has had the approval of the sub-committee in charge of it, as well as that of the executive officers of the school committee responsible for its supervision.

In agreement with this policy, the headmaster and his associates have built up a school which has stood in the front rank of similar institutions throughout the country. Few schools can show among their teachers a better *esprit de corps* or, on the part of their pupils, a finer spirit of manliness and studious attention to work. Few schools, indeed, possess instructors of greater teaching ability or more sympathetic understanding of adolescent boys. Abundant credit should be given those charged with the administration of the school for the wisdom, the skill, the large executive ability, and the incessant labor necessary to develop such an institution.

In recent years, however, the School Committee has adopted a change of policy for this school. It is with the administration and development of the institution in the light of this new policy that this report is primarily concerned.

4. *Method of the report.*—In making this study, the Boston School Committee, as the final authority, was asked to state the purpose it wished the school to accomplish. The effort has been made to test the school by this aim. To a very large extent, the study has relied upon the headmaster for information. This information he has always been very ready to furnish and the findings given herein are largely based on data obtained from this source and included in the Appendix of this report. (See Appendix E.) The thanks of the writer are due the headmaster for his kindness and courtesy in giving his assistance in this manner. The data from the school office were supplemented

by a number of visits to the school and conferences with the members of the faculty. The records of the Boston School Committee, the reports of the Mechanic Arts High School and the Massachusetts Institute of Technology, and answers to printed questions by students both of the English High School and the Mechanic Arts High School, have also been drawn upon for information.

Grateful acknowledgment is here made of the exceedingly valuable information and helpful suggestions contributed by a number of persons, particularly by Mr. Arthur Williston, director of Wentworth Institute, and for the active and able assistance of Mr. W. A. O'Leary, director of Evening Training Classes for Teachers at Pratt Institute, in the preparation of this report.

FINDINGS IN BRIEF

1. *The aim of the Boston School Committee for the school is,* as has been stated, the preparation of boys for advantageous entrance into industry on the business and directive side. The Committee has said it is not the function of the school to prepare for the engineering college.[1]

2. *The aim of the school itself seems to be at variance with that of the School Committee.* This is indicated by the published reports of the school setting forth the aim of the course of study, the course of study itself, the statements of the headmaster, the text-books used, the type of examination given, and the character of the instruction. Instead of aiming to prepare boys for advantageous entrance into industry on completing the high school course, there is every evidence that the controlling aim of the school is to give boys general education and to fit them to enter the engineering college.

3. *Some of the students of the school wish to be prepared for industrial careers* of the kind contemplated by the school committee. Evidence of this is found in the fact that less than 15 per cent go to higher institutions, and that a fair percentage appear to go into some form of industrial work.

4. *No attempt is made to select boys who wish to be trained in accordance with the stated aim of the school committee.* There is no organized method of reaching such boys or bringing the school to their attention and no attempt is made either at or before the time of entrance to determine a pupil's purpose in selecting the school or his fitness to take the special training it is expected to offer.

5. *The course of study is not the right kind to give the training desired by the school committee.* It is too abstract and too far removed from the practical experiences the pupil will meet

[1] Throughout this discussion the term engineering college will be used to mean a school of college grade, like the Massachusetts Institute of Technology, or the Worcester Polytechnic Institute, offering instruction in engineering branches. The term will be used as synonymous with the expressions: the technical school or college, the higher scientific school, and the higher technical school.

when he goes into industry. The academic part of the course is essentially the same as that of any general high school.

6. *The kind of instruction is not that required to prepare boys for industry.*—The shops are largely organized on an exercise basis and the instruction throughout the school, principally owing to the lack of correlation between shop and classroom, is not sufficiently practical.

7. *The classes are much too large* for efficient work. This is especially true in the shops. To a certain extent large classes appear to have been a conscious policy of the school in the effort to keep down the cost of instruction.

8. *The majority of the instructors of the school are well qualified* to give the kind of instruction required by the aim of the school committee. Many of them have a large asset of practical experience which the school is not now utilizing to best advantage. A few are not equipped to train boys for industrial pursuits and probably cannot acquire the necessary qualifications.

9. *The shops and equipment of the school are in the main admirably adapted* to training boys in accordance with the aim of the committee. The shops, however, are too crowded and the shop equipment is not sufficiently varied. Some of the equipment necessary for efficient instruction in printing and the application of power in industry is lacking.

10. *The school is not necessary as a preparatory school* for the engineering college. The English High School is preparing nearly as many pupils for the engineering college and appears to be doing it at least as well and probably better than the Mechanic Arts High School.

11. *The school fails to meet the needs of the 85 per cent of its pupils* who do not go to the engineering college, because it serves primarily the interests of the 15 per cent of its pupils who do.

12. *The headmaster is evidently not in agreement with the School Committee* regarding the purpose of the school.

Summary of Recommendations

This report makes the recommendations that:

(1) No changes of any kind be put into effect before September, 1914.

(2) All classes now in school be allowed to graduate on the present basis.

(3) All changes be made gradually beginning with the class of 1918.

(4) The school gradually abandon all attempt to fit for the engineering college and confine its instruction to preparing boys for industry in accordance with the aim of the school committee given herein.

(5) The course of study be immediately reorganized for the first year, according to the suggestion given in Appendix D and be put into effect in September, 1914.

(6) The whole course be gradually reconstructed according to the suggestions given herein.

(7) Such subjects as foreign languages, general science, and general mathematics, which belong to the field of general education or of college preparation, be eliminated from the course.

(8) Suitable agencies be established for finding and selecting boys who wish to be trained for industrial careers and who have the right kind of interest and ability.

(9) The shops be organized on a commercial basis.

(10) Instruction in the shop, the classroom, and the laboratories be more closely correlated with each other.

(11) The customary use of text-books be largely discarded and the materials for instruction be gathered from such sources as the school shops, outside plants, and trade literature. Experience goes to show that instruction, when given by highly competent teachers, can be worked out much more pedagogically without the conventional use of the usual text-book which should serve as reference rather than as lesson plan.

(12) Visitation to industrial plants and lectures by business men and experts from outside plants be included in the instruction.

(13) All instructors be required to have some industrial experience as a qualification for service and those who do not have such contact or cannot acquire it be gradually transferred to other high schools and replaced by those who do possess such qualification.

(14) Varied equipment, as described later, be added to the school.

(15) The school day be lengthened to 7 hours for the class of 1918, of which not less than six shall be given to actual instruction.

(16) The number of pupils in shop classes be reduced to not more than 28 to each teacher.

(17) Shop work be required of every pupil throughout the course.[2]

(18) A placement bureau, in charge of a vocational counselor, be established.

(19) The course be so arranged that boys may elect drafting during the last year, or may specialize in some one industrial field.

(20) Boys who discover after entering the school that they wish to prepare for the engineering college be transferred to some other high school, and it be the duty of a special vocational guidance committee to advise concerning such transfers and see that they are made to best advantage.

(21) Part-time courses of instruction be established which will enable the school to place its students on actual industrial work, while taking training for a portion of their time in the classroom, and which will enable those who have gone to work to secure through the school the further preparation they need.

Points of Agreement with the Findings Regarding Existing Conditions Described by Previous Reports

The findings of this report agree with those of Mr. Arthur Williston made in a previous report in every main condition, and especially in the following particulars:

(1) No adequate system is maintained for selecting boys for admission to the school.

(2) Preparation for the engineering college is the controlling aim of the instruction.

(3) Mechanical branches taught do not furnish adequate mechanical training.

(4) The small per cent of pupils who go on to higher institutions of learning can be cared for in other high schools.

(5) The teaching of many subjects, such as physics and mathematics, is too academic.

(6) Shop work is not sufficiently practical in character.

(7) There is a lack of correlation between the work of shops and classrooms.

(8) English is well taught.

[2] An exception should be noted in the case of the elective course in drafting in the senior year. (See p. 32.)

(9) History is not sufficiently industrial in character.

(10) Classes are too large.

(11) Shop instructors are required to teach too many periods.

(12) Cost of instruction is abnormally low.

(13) The English High School offers better preparation for the engineering college than does the Mechanic Arts High School.

(14) The equipment is inadequate to train for industry in a practical way.

Points of Agreement with the Recommendations for Changes Made by Previous Reports

This report agrees with the reports of Mr. Williston and of the Business Men's Advisory Board in regard to the following recommendations.

(1) Systematic plans should be put into effect for reaching the right group of pupils.

(2) Only those qualified to profit by industrial training should be admitted to the school.

(3) The school should give up all attempt to prepare for the engineering college.

(4) The school should aim to prepare boys for industrial vocations.

(5) All instruction in foreign languages should be omitted.

(6) Work in pure mathematics should be reduced and instruction both in science and mathematics should be specialized.

(7) Shop work should be prescribed for everybody throughout the course.

(8) There should be some latitude in the choice of course in the fourth year.

(9) Classes should be reduced in size.

(10) The school day should be lengthened.

(11) A placement bureau should be established.

(12) Records should be kept of the boys' experience and success in the industry after graduating from school.

(13) More shop space should be provided.

(14) The equipment of the shops and laboratories should be so far as possible such as would be found in the shops, tool rooms, and testing rooms of commercial plants.

(15) Arrangements should be made for the transfer of misfit pupils from the Mechanic Arts High School to other schools.

FINDINGS

I

WHAT IS THE PURPOSE OF THE SCHOOL AS DEFINED BY THE SCHOOL COMMITTEE?

1. *Purpose of the school as stated by the Committee.*—The School Committee, in instituting a change of policy, has officially stated the purpose of the school to be "the preparation of non-commissioned officers of industry."[1]

2. *The term "non-commissioned officer,"* as just stated, is here used to mean a subordinate executive or assistant on the business and directive side of productive industry. He may, for example, be a detail designer or engineer's assistant in a factory or manufacturing plant, or the motive power department of a steam or electric railway; an assistant engineer for a power plant or office building; an inspector for a factory and steam boiler insurance company; a salesman for the sales department of factory and machine houses; a tester of apparatus; a sub-fore-

[1] "The Mechanic Arts High School is designed to prepare boys for industrial efficiency. Training for industrial efficiency may be of at least three different kinds: (1) That which fits for productive skill as an advanced apprentice looking forward to journeymanship and leadership on the *productive* side of industry, such as is represented by the training given in the Boston Independent Industrial School for Boys (Brimmer Building) and in other all-day schools, of the same type together with part-time and continuation schools, yet to be established; (2) that which, by the advanced instruction in technical colleges like the Massachusetts Institute of Technology, fits for technical insight giving favorable entrance as a commissioned officer in business and industry, looking forward to leadership on its technical and business side; secondary school preparation for such technical colleges is being given satisfactorily by other Boston high schools and according to previous decisions of the School Committee, is not hereafter to be a part of the work or service of the Mechanic Arts High School; (3) that which aims to give through a school of secondary grade both the technical knowledge and the elementary experience in certain industrial processes which will make the pupil 'industry and business wise' as a preparation for favorable entrance as a non-commissioned officer in industry looking to promotion and leadership on its business and directive side.

"It is the belief of the School Committee that inasmuch as the first two of the different kinds of training for industrial efficiency are being given satisfactorily by other Boston institutions, the purpose of the Mechanic Arts High School should be to confer the third, and that the training of this character given by the Mechanic Arts High School should meet the same demand in industry which the High School of Commerce is attempting to meet by fitting boys to become non-commissioned officers, in business and commercial pursuits."—*Statement of Boston School Committee in correspondence relating to this report.*

man; an assistant manager or chief. These titles carry various meanings in different industries, but in general this type of employment is filled by a subordinate executive rather than a highly technical expert. A very suggestive list of the many different kinds of positions to which the work of the school should lead is given in Appendix K.

The non-commissioned officer should know the general processes, methods of production, materials, and machines of productive industry, as well as shop and business organization. He need not have the skill of hand of the trained workman or the special knowledge of the technical expert, but he should have an appreciative understanding of both good workmanship and technical knowledge.

On graduating from the school the pupil would not, of course, be ready to assume immediately the leadership for which he had been preparing. While his training should enable him to make advantageous entrance into his future work he would still have to acquire the expert knowledge of business and industry and the judgment, essential to leadership, which comes only through experience. On entering business, therefore, he might well be termed a novitiate in industry who is looking forward to serve as a prospective officer or as a sub-engineer of industry.

No amount of schooling or technical training however desirable and excellent can take the place of actual experience in industry itself. Both are necessary. The pupils in the school should be given the discipline of hard work as well as a knowledge of how to work. They should be made at the outset to understand that much straight hard work in subordinate positions lies before them. The Mechanic Arts High School should give them a type of training which will fit them to go out into industry with enough power and practical usefulness to get a good start with the prospect always ahead of advancement in proportion to their ability and effort.

For several years a few commercial high schools have been training the commercial cadet for business, leaving largely to the private business college the task of preparing the skilled workers in the ranks such as bookkeepers, stenographers, and typewriters. The Boston High School, of Commerce, for example, is definitely engaged in training boys for such advantageous entrance into commerce as shall enable them to fill

eventually subordinate executive positions at least in the distributive as contrasted with the productive side of business. It is the understanding of this Report that the School Committee desires the Mechanic Arts High School to serve in a similar way in the preparation for advantageous entrance into industry of industrial recruits, who shall eventually fill subordinate executive positions at least on the productive side of industry.

3. *The statement of purpose quoted above is in accord with the policy adopted by the School Committee* several years ago, with reference to the purpose and administration of its high schools. That policy was to maintain a number of high schools like the English High School, the Latin Schools, and the various district high schools, whose aim should be to give general preparation for life, including preparation for higher institutions of learning, and to surround those schools with special schools like the Boys' Industrial School, the High School of Commerce, and the Girls' Trade School, whose aim should be to give to particular groups special preparation for specific kinds of service. This action of the School Committee took the Mechanic Arts High School out of the class of general high schools and made it a special school and gave it as definite an aim as that of any other special school.

4. *The difference between the Mechanic Arts High School and the Boston Industrial School for Boys.* It may be well here, for the sake of clearness, even at the risk of prolonging the discussion, to point out the difference between the aim which the Boston School Committee in the foregoing correspondence has set up for the Mechanic Arts High School and that for the Boston Industrial School for Boys.

The latter school is intended for boys who desire to be prepared to enter, as advanced apprentices looking toward journeymanship, such skilled trades as those of the machinist, carpenter, electrician, and printer. The Mechanic Arts High School is designed for the boy who expects to enter productive industry, not as an apprentice to a skilled trade, but, in a sense, as an apprentice in organization, management, or both.

Since the completion of an elementary school course is not absolutely necessary to a fair degree of success in the trades, the Boston Industrial School for Boys does not require a common school diploma, its entrance requirement being the ability to

do the work of the school successfully. Since the callings open to the graduates for which the Mechanic Arts High School prepares, are of a higher grade, only graduates of the common school are admitted.

5. *A special school has to meet certain conditions* which a general school does not have to meet because it has been charged with a special instead of a general duty. It must secure a group who want the particular kind of instruction the school has been directed to confer; it must give its pupils a training which obviously prepares them to realize the aim established by the committee; and the great majority of its graduates must show as a result of their training efficient service in the particular field the school is intended to serve.

When the United States government established at Annapolis an academy for the special purpose of training officers for the navy, it became the duty of those in charge of the institution to accept for training only those persons who wished to become naval officers. Having secured such a group it was clearly the business of the naval academy to give the cadet the kind of training which obviously fitted him to become a naval officer. To justify its existence the academy at Annapolis must further show that the great majority of its graduates actually enter the navy and that they continue in the service as successful officers.

6. *Four tests of the school:* The answer to the question "How far is the Mechanic Arts High School meeting the aim of the School Committee?" depends, therefore, upon what answers can be returned to the further questions:

(a) Is the aim of the school in accord with that of the committee?

(b) Is the school reaching the group who wish to be trained for industrial careers in accordance with the aim of the School Committee?

(c) Is it giving the right kind of training for this purpose?

(d) Are the graduates of the school, on the whole, going into industry in the kinds of positions contemplated by the Committee in their statement of aim?

II

HOW FAR DOES THE AIM OF THE SCHOOL AGREE WITH THAT OF THE SCHOOL COMMITTEE?

1. *The aim of those charged with the administration of the school is not in accord* with that officially authorized by the School Committee. The published reports of the school, the statements of the headmaster, the course of study, the character of the instruction, and the occupations of the graduates all show this to be true.

2. *The published reports of the school give its aim as general education* rather than vocational training. The first report issued in 1897, four years after the school was opened, states, in effect, that it is not the controlling aim of the school to "give vocational preparation, but an all-round education."[1]

3. *An examination of the statement just quoted shows that the school never specifically aimed to prepare boys for productive industry.* It is there stated that the primary purpose is to secure an "all around development of the pupil" and that "the training which it gives is as valuable to a boy who is to become a lawyer or a physician as to one who has to work at the bench or to superintend a manufacturing plant." It is also pointed out that "the work is not arranged with special reference to vocational ends" and implies that preparation for profitable employment is regarded as a by-product. The primary aim of the school, therefore, so far as it can be gathered from the printed reports, is not vocational training—as is intended by the School Committee—but general education.

The revised copy of the report of 1897, issued in 1903 and still circulated from the school office, phrases the aim in essentially the same words. The course of study printed in 1897 was slightly modified in 1903. Except for the substitution of ele-

[1] "While the primary purpose of the school is to secure the harmonious development of all the powers of the pupil, without special reference to vocational ends, the fact is not overlooked that the manual dexterity and knowledge of mechanical principles acquired at school will be, for many boys, the immediate stepping stones to profitable employment."—*School Document No. 2, 1897.*

mentary science in the first year, for one-half the time, formerly given to drawing, there has, since that date, been no change in the printed course.

During this period there have been pronounced developments in the fields of secondary technical and vocational education, not only in methods of instruction but also as to the aim and content of the courses of study. With this development there has also come a clear distinction between manual training and vocational education and a new understanding of the function of the manual training and the technical high schools. The fact that meanwhile the school has not materially changed either the aim or the course of study raises the question of how far it has adjusted itself to meet the changing educational thought of the times.

If it be objected that the reports referred to above are out of date, it should be noted that they are still distributed from the school office to grammar school teachers and others and that they contain practically unchanged the course of study now in use, which is a large index of the aim.

4. *These reports give preparation for college as a large aim* of the school. "The primary purpose of the course is to meet the needs of boys whose school life is to end with the high school, but it also provides excellent preparation for the higher scientific schools. The training in shop work and drawing enables pupils who enter such higher institutions as the Lawrence Scientific School of Harvard University, or the Massachusetts Institute of Technology, to anticipate equivalent work in those institutions, and thus gain valuable time for advance courses."[1]

5. *The headmaster of the school admits that the school is to a certain extent a general high school* offering cultural education as its dominant purpose, but he apparently believes that the aim and course of study as contained in the published reports just quoted should not be materially changed.[2]

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[1] School Document No. 2, 1897, page 1.

[2] In a series of questions submitted to him as a part of this study among others were the following: (1) Do you regard the Mechanic Arts High School as a general or vocational school? (2) If it is a general high school, how does its work differ from that of the usual high school? (3) If it is a vocational school, for what vocations or trades or occupations does it fit?

The replies to these questions follow:

"The curriculum of the Mechanic Arts High School includes many of the branches usually found in high schools, and they are taught in the same way except that de-

6. *The headmaster believes that the instruction of the school should prepare boys for the engineering college.* It seems fair to infer from his answer to the question given below that he advocates one course of study which at the end of four years will enable all pupils to pass successfully the entrance requirements of the engineering college.[1] Nowhere does he suggest differentiated courses of study with different aims, but rather that as "a fundamental principle" the institution "should be properly articulated with the schools below and above it" so that there might be "movement from it to higher institutions of the same type"—which he declares to be "fitting and logical."

The headmaster also presents a defense of the policy of the school as a preparatory institution in the way in which it has been carried out in the past and attributes the falling off in attendance to the action of the School Committee in declaring a change of policy as regards the purpose of the school.[2] While it may not be fair to interpret these statements as fully repre-

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cidedly more emphasis is given to industrial history, and to the practical application of science and mathematics. The subjects peculiar to it are taught so as to give substantial knowledge of the elementary facts and applications of the fundamental mechanic arts. This curriculum has proved singularly attractive and inspiring to many boys, and has given very valuable general culture of a type distinctively different from that which results from the standard high school training. To the extent indicated in the foregoing it is a general high school.

"It tends strongly, however, to arouse interest in occupations in which the special training of the mechanical departments can be utilized. It furnished a good preparation for a large variety of occupations related to the industries and in which the knowledge of drawing and mechanical processes are important elements of success. To that extent it is vocational."

[1] To the further questions: "Do you believe that the course of study of the Mechanic Arts High School should continue to serve as a preparation for the technical college so that at the end of the four years' course the pupil could meet its entrance examinations? If so, why?" he makes the following reply: "I believe that one of the functions of the school should be to prepare boys for technical colleges. It was organized in 1892 as a high school. A fundamental principle of that organization was that it should be properly articulated with the schools below and above it. Movement from it to higher institutions of the same type has always been recognized as fitting and logical.

[2] "That an intelligent community desires the continuance of this policy is conclusively shown by the record of enrollment. The rapid reduction in applications for admission and in the percentage of persistence in the various classes since 1909 has been very largely due to the announcement by the School Committee of the intention to make a radical change in the course of study. . . . .

"If there are defects of organization or administration they should be remedied without radical changes calculated to disturb the public mind and give the impression that the school has not accomplished its purpose. The records show clearly that it has done successfully the work for which it was organized. If new aims are desirable, in view of changed economic, industrial, or social conditions, a course adapted to meet those ends should be developed in harmonious relationship with existing work."—*Reply to questionaires by the headmaster.*

senting the position of the headmaster, they at least indicate his faith in the purpose and work of the school as it is at present organized and a lack of agreement with the changes proposed by the School Committee.

7. *Every evidence shows a variance in aim* between the work of the school and the purpose of the School Committee. It is sufficient to point out here that such things as the presence of certain subjects in the course of study, as for example, French, and the absence of certain others, such as economics and shop management; the specific aims in the teaching of the various subjects as given in the report of the school; the high per cent of academic work as compared with a low per cent of shop work; the non-commercial basis on which the shop work is organized; the absence of business and executive training—are all indications that it is not the conscious aim of the school to train for executive positions in productive industry. It seems fair to say that where students achieve this aim as they, like the graduates of other schools sometimes undoubtedly do, the result is an accidental by-product largely dependent upon native qualities.

8. *In view of the evidence presented above,* the writer believes that the aim of the Mechanic Arts High School is essentially that of a school offering to its pupils a general education of the kind given by the English High School, supplemented by a certain amount of manual training of the conventional kind. It is needless to point out here how far this differs from the task of preparing those who wish to go directly from this school into industry.

III

HOW FAR IS THE SCHOOL REACHING BOYS WHO DESIRE PREPARATION FOR INDUSTRIAL CAREERS?

1. *A special school always means a special group of pupils.* This fact cannot be too strongly emphasized. Certain limitations and standards as to the kind of boys the school would be expected to serve are set up when the School Committee establishes as the aim of the Mechanic Arts High School, the preparation of "non-commissioned officers of industry." In taking this action the School Committee, as previously suggested, has in effect ruled that the school shall accept for training only those boys who wish to be trained for industrial careers, and who have the ability to profit by such training. It is a waste of public money to prepare persons for work which they will not or cannot follow.

2. *The school has made no special effort to get this kind of boy.* No machinery has been set up for his selection, in spite of the very strong recommendation to this effect in the report of Mr. Williston. As has already been pointed out, the aim to prepare for industrial careers has not been advertised by the authorities of the school as a controlling purpose. The headmaster himself admits that the boys have been admitted to the school on the same basis and through the use of the same methods of selection as the pupils of other Boston High Schools[1]; but claims

[1] "The choice of a high school is usually made in the light of such information as the boys and their parents get from other boys who have attended high schools, or their parents, supplemented by the statements of the principals of the grammar schools.

"As the decision touching from 300 to 600 boys had to be made in a single day, it was obviously impossible to obtain and consider adequately the data suggested by your questions, or to conduct interviews with parents."—*Replies to questionaire by the headmaster.*

"Since September, 1907, practically all boys who have applied for admission to the Mechanic Arts High School have been admitted. From 1902 to 1907 inclusive, a considerable number were refused on account of lack of accommodation, but for no other reason. . . . Applicants were received on the basis of general records for scholarships in the grammar school. . . . After a full discussion the Committee on Manual Training of the School Board decided unanimously that a selection on the basis of merit as determined by the grammar school record was the only definite plan."—*Replies to questionaire by the headmaster.*

that to a very large extent the school does reach the boy desiring to be trained for industry.

3. *The pupils of the school necessarily enter with a variety of aims.* The reasons are obvious. Given an institution whose controlling purpose is to afford general education as well as preparation for the engineering college, which, like any general high school, admits all applicants holding a grammar school diploma, and which offers an opportunity to take in addition a course in manual training of the conventional kind, three kinds of students must inevitably result: (a) Those desiring to be fitted for the engineering college; (b) those desiring to add to a regular high school education an elementary experience with tools; and (c) those desiring preparation for positions in industry.

4. *The presence of these three classes of students in the school is shown by the statements of the pupils themselves,* as to their motive in taking the work. One-half of them at entrance express an intention of going to the engineering college, although less than 15 per cent ever actually attend such an institution. The fact that less than one out of three of the prospective students of the engineering college ever attend it would seem to indicate that some of them, how many it is, of course, impossible to learn, gave such an answer without any very serious purpose to support it.[1] Out of the remaining 50 per cent, probably from twenty to twenty-five per cent desire a general education with manual training.[2] The remainder come to get preparation for positions in industry.

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[1] "For a series of years, a little less than half of the members of the first year class declared their intention of going to a technical college; probably about half of that number have, at the outset, a fairly fixed intention of taking a higher course."—*Replies to questionaire by the headmaster.*

Further figures obtained through the school office in 1912, given in Appendix J of this report, show that in March of that year, of the total number of pupils in the school, approximately 42 per cent reported their intention of going to college; 40 per cent reported they were not going; and the remainder were undecided. In the senior class, 44 per cent said they were going, and 6 per cent were undecided.

[2] Questionaires as to their future occupation and their motive in coming to the school were given to 112 boys selected at random, the method being to take boys whose names began with the letter S. Of this number approximately 40 per cent said they intended to enter the Engineering College or other higher institution of learning, or that they chose the Mechanic Arts High School because it offered preparation for such institutions, while about 10 per cent were undecided as to whether they intended to go to the engineering college. Of the remaining 50 per cent, about one-half, or approximately 25 per cent of the whole number questioned, apparently intended to go into productive industry. The remaining 25 per cent had evidently

This estimate seems to be borne out by the replies of certain pupils to the questionaire described in the preceding footnote. There is every reason to believe that these come to the Mechanic Arts High School largely because it is the only high school in the city which promises preparation in any way related to what they wish to do on leaving school. Less than one out of ten of these have any intention of becoming productive workers in the trades in which the school offers a little elementary instruction, such as those of the machinist, carpenter, pattern maker, and blacksmith, and the number who follow such callings may be regarded as negligible. Indeed, an examination of the table giving a comparison of the occupations of graduates of the school and of the English High School would seem to show that on the whole at least as many graduates of the latter become journeymen workers in skilled callings as of the former. (See Appendix G.)

5. *The records of the pupils after leaving the school confirm the foregoing statements* regarding their varying aims. Here again it has been impossible to secure any extensive and thoroughly accurate information. The school has never organized a placement bureau or kept accurate and systematic records following up the careers of graduates or of boys who drop out before completing the course. This report has been compelled to rely for its data upon certain returns made by graduates to the headmaster in response to a circular letter sent out in 1908 and at class reunions since that time. These returns are necessarily fragmentary and unsatisfactory and can be relied upon only as showing general tendencies as to occupation of the more successful graduates of the school.

Approximately four out of every ten pupils leave before graduation. It should be said in passing that measured by the proportion of its enrollment which remains to graduate, the Mechanic Arts High School has been more successful than any other Boston high school. And there is every reason to believe that if the aim of the school were made more definite this percentage would be still higher. There is absolutely no record of any character at the school concerning the 40 per cent who

come to the school for a wide variety of reasons. Of this group approximately 10 per cent intended to go into business pursuits, while most of the remaining 15 per cent were evidently in the school for no definite purpose. It should be noted that the 112 boys composing the group questioned included not only boys in the first year class, but also boys in every class in the school, some of whom had undoubtedly been turned towards industrial life by their experience in the school.

withdraw, after their names are stricken from the roll. The headmaster says that they "generally accept whatever employment they can secure without much regard to their native aptitude or training." This means that they follow the usual employments of high school pupils who fail to finish the course.

Of the 60 per cent who graduate, less than one out of four go to the engineering college. The remaining three out of every four, on finishing the course, go into a wide variety of occupations of the kind usually taken up by graduates of the regular high school. A comparison of the occupations of graduates of the Mechanic Arts High School and the English High School, who do not attend the engineering college, shows that they distribute themselves among about the same kinds of employment. Nor does it appear that those from the former school follow very much more frequently than those from the latter, callings either on the productive and distributive, or the business and directive side of industry. (See Appendix G.) Only a small per cent of the graduates become "non-commissioned officers of industry" as the term is defined by the School Committee. Here again it was impossible to obtain entirely satisfactory information since all the statistics regarding the occupations of graduates gathered by the school deals with them as one group and therefore makes impossible any study of the employments of those who attended the engineering college separate from that of those who did not.

It is only fair to say here that the headmaster of the school claims "that a large percentage of the graduates have found employment appropriately related to the special training which they have received." The strength of this statement depends, of course, upon just what occupations may be considered "appropriately related" to "the special training which they have received." He also claims that "not far from 65 per cent become draftsmen, electricians, foremen, superintendents, and salesmen, or engage in some other occupations more or less connected with the industries."[1] All of the data gathered for this report seem to indicate that the number of those employed as skilled workmen or on the business and directive side of pro-

[1] In Appendix J of this report a partial list covering some 90 occupations is given to which the training of the Mechanic Arts High School should lead if the aim of the school committee were carried out.

In Appendices E, F, and G are given tables showing the occupations of graduates of the Mechanic Arts High School, obtained through more than 900 responses to a

ductive industry not including graduates and former students of the engineering college in any capacity is nearer 35 than 65 per cent.

Conclusions

Whatever may be the exact figures as to the number of boys who come to the school to be prepared for industry on the business and directive side, the following facts appear to be true:

(1) About 50 per cent of all the pupils who enter the school do so with a more or less vague intention of being prepared for the engineering college, but less than one out of seven of these ever actually attend the engineering college.

(2) About 40 per cent of all the pupils who enter the school fail to finish the course and so far as after-employment is concerned go the way of the usual high school pupil.

(3) About 25 per cent enter for purposes of general education with manual training. To this number must be added certain others who, on entering, intended to prepare for the engineering college, but during their course have abandoned this purpose.

(4) About 25 per cent of each entering class wish to be prepared for some form of productive industry. To this number must be added those who enter for the purpose of preparing for the engineering college, but later go into industry.

(5) From the standpoint of the aim of the School Committee to use the school for preparation for industrial careers, the institution has been not more than from 25 to 35 per cent successful in reaching the kind of boys desiring this training.

(6) On the other hand, it is unquestionably true that a large proportion of all the boys—including many who aspire to the engineering college, many who fail to finish, many whose purpose for lack of accurate knowledge now appears to be general; and also including all of the 25 per cent who indicate industrial aims—would, if the school had a more definite and clearly defined industrial aim, find their own more or less indistinct and indefinite industrial ambition crystallized and would, consequently, cordially welcome an opportunity for an intensive industrial training.

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questionaire sent out by the school office to all graduates. While the method is not sufficiently extensive or the data so classified as to warrant hard and fast conclusions it seems only fair to point out that according to these returns not more than about 14 of these 90 occupations are now being followed at all by the graduates of the school who do not attend an engineering college, and that not more than about 20 were being followed by all graduates. It is to be further noted than an examination of Appendix G will show that about 13 of these occupations are being followed by graduates of the English High School, as shown by 808 responses.

IV

IS THE SCHOOL GIVING THE KIND OF TRAINING WHICH THE AIM OF THE SCHOOL COMMITTEE REQUIRES?

The Course of Study

1. *When the School Committee set up a special aim* for the Mechanic Arts High School, it, in effect, directed that the course of study should be such as to insure the efficient training of those who go directly from the high school into industry. This action limits the instruction to this specific purpose, predetermines a certain kind of course, and automatically excludes all subjects that do not directly contribute towards this particular aim.

2. *The course of study printed in the school report is not the right kind* of course to give the training contemplated by the School Committee. In order to understand in what respects the present curriculum fails to meet the aim of the Committee, it is first necessary to determine what training for industry should be.

It has already been pointed out that as "a non-commissioned officer" he is to be concerned with production on the business and directive side. His training should include instruction along two general lines: viz., methods of production in industry and business practice and organization as applied to manufacturing.

Training on the productive side should be largely given through shop practice and should include instruction in the tools, machines, materials, and processes employed in manufacturing plants; shop organization; the economics of production; and the applications of science, mathematics, and drawing to manufacturing and mechanical work.

Neither extreme productive capacity nor extreme technical ability should be the aim of this part of the training of the pupil. It is not the purpose of the school to turn out prospective skilled mechanics in metal, wood, electricity, or any other industry,

nor to train technical experts, such as a designer for a cotton mill or a chemist for a rolling mill, but rather to send out young men who, through shop experience and instruction in at least a few typical industries, have gained an intelligent idea of the methods of manufacturing establishments so far as these can be profitably learned by a high school boy.

On the business and directive side, the training should aim to make the pupil "business-wise" in the affairs of industry. To this end, the course should include instruction in the elementary principles of business procedure, business organization, applied economics and the practical applications of science, mathematics, drafting, and English, as these subjects enter into the business transactions of a manufacturing or a construction business.

As a future worker in industry and a citizen, the pupil should understand his social and civic rights and responsibilities and should know and have an intelligent interest in the way the city, state, and nation carry on the business of government. Instruction in the practical affairs of citizenship should, therefore, be included in the curriculum.

3. *The present course of study for the school* as obtained from the headmaster follows:

PRESENT COURSE OF STUDY FOR THE MECHANIC ARTS HIGH SCHOOL, 1913–14

FIRST YEAR

	Periods per Week	Mos.
Algebra	5	10
General History	2½	10
English	2½	10
Elementary Science	2½	5
Drawing	2½	10
Carpentry	2½	7
Wood-carving	10	3

SECOND YEAR

	Periods per Week	Mos.
Algebra	2½	10
Plane Geometry	5	10
History of the U. S. and Civil Government	2½	10
English	2½	10
French	2½	10

Drawing	2½	10
Wood-turning and Pattern-making	10	5
Forging	10	5

THIRD YEAR

	Periods per Week	Mos.
Solid Geometry	5	5
Plane Trigonometry	5	5
Physics	2½	10
English	2½	10
French	5	10
Drawing	2½	10
Machinist's work—with hand tools mainly	5	3
With machine tools mainly	5	7

FOURTH YEAR

Trigonometry: Applications to physics, surveying, and navigation	2½	10
Physics, laboratory work	2½	10
Chemistry	5	10
Algebra	2½	10
Geometry	5	10
History of the United States	2½	10
English	2½	10
French	5	10
German	5	10
Drawing	2½	10
Machine shop practice, and projects involving the shop work of preceding years	10	10

4. *The course of study recommended by this report is as follows:*

PROPOSED COURSE

FIRST YEAR

	Periods per Week	Mos.
Applied Mathematics	5	10
Shop Arithmetic, dealing with practical shop problems along the lines indicated in Appendix D, pages 73–74, and leading into Elementary Algebra. Applied Geometry of an elementary character such as grows out of the arithmetic, drawing, or shop courses.		
English	5	10
The work in English is described on pages 79-81 To alternate every other day or week with Citizenship.		

Citizenship..... 5 10
The work in Citizenship is described on pages 75-76. To alternate every other day or week with English.
Science..... 5 10
Simple mechanics and the properties of materials to be taught through laboratory methods in double periods every other day, alternating with mechanical drafting. See statement regarding the work, page 76.
Mechanical and Free Hand Drafting..... 5 10
Practical shop drawing to be given in double periods every other day, alternating with science laboratory.
Shop Work and Carpentry.....10 to 15 10

30 to 35

SECOND YEAR

	Periods per Week	Mos.
Applied Mathematics.....	5	10
A continuation and extension of the course in first year in accordance with the suggestions outlined on page 76 to 77 of Appendix.		
English.....	5	10
Alternating every other day or week with history.		
Industrial and Economic History of New England and the United States.....	5	10
As discussed in Appendix B, page 74. To alternate every other day or week with English.		
Applied Science.....	5	10
With special reference to the industrial uses of heat, light, and power, as discussed in Appendix B, page 76. To be given in double periods every other day, alternating with mechanical drafting.		
Mechanical Drafting.....	5	10
Alternating with the science work in double periods every other day.		
Shop Work—Forging and Patternmaking.....	10 to 15	10

30 to 35

THIRD YEAR

	Periods per Week	Mos.
Applied Mathematics.....	5	10
English.....	5	10
Alternating every other day with history.		

	Periods per Week	Mos.
History. A presentation of the world's progress with special and constant reference to the industrial and economic causes and factors involved. Alternating every other day with English, see page 74.	5	10
Applied Science. Industrial Chemistry and the strength of materials —taught in double periods every other week, alternately with mechanical drafting.	5	10
Mechanical Drafting. Taught in double periods every other week, alternating with science.	5	10
Shop Work. Machine shop practice and machine construction	10 to 15	10
	30 to 35	

FOURTH YEAR

	Periods per Week	Mos.
General Mathematics. Organizing, systematizing, and advancing the applied mathematics of previous years with constant applications of principles to practical work.	5	10
English. Alternating every other day with economics.	5	10
Economics and Organization. Economics based on the background of economic history previously taught and dealing with economic law and its application to modern day industrial problems as discussed in Appendix B, page 74. Organization to deal with practices in business, shop, and organization as discussed in Appendix B. Economics and organization twenty weeks each. The two as one course alternating every other day or week with English.	5	10
General Science. Unifying and organizing the results of the laboratory work and practical experience of previous years and giving more advanced instruction of a quantitative character in mechanics, industrial chemistry, and power. Double periods every other day.	5	10
Mechanical Drafting. Taught in double periods every other day.	5	10
Shop Work. The pupils should be offered a choice of a year's work from any one of the following courses, or from as many as are desired: architectural construction; machine construction and tool making; advanced woodwork and pattern making; electrical industries, including power.	10 to 15	10
	30 to 35	

5. *A comparison of the two above courses of study* reveals the following points of difference[1]:

(a) While both courses offer instruction in such subjects as English, mathematics, science, history, shop practice, and civics, the aims, contents, underlying pedagogical theories, and methods differ widely, as has already been suggested, and will be further shown in this report.

(b) The present course of study offers instruction in the following subjects not included in that proposed by this report:

(1) French.
(2) German.
(3) General college preparatory courses in such subjects as mathematics, science, and English.

However important instruction in these subjects may be as part of a general education or as preparation for college, they have no more to do with the business of manufacturing than have Latin, Greek, or any other cultural subject and do not belong in the curriculum of a special school whose aim is to train prospective officers of industry.

The differences between the general courses of mathematics and science now offered in the school and the special courses herein recommended have already been referred to and are further discussed in the following paragraphs. Wood-turning, carving, and many other parts of the shop work, also in the present course of study, have no place in the course if the school is to accomplish the Committee's aim.

(c) The present course does not give instruction in the following subjects:

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[1] The proposed course of study given above is one which the writer, after careful consideration of the possible resources of the school and the problems to be met believes to be the most feasible scheme at the present time. At the same time he desires to point out that this course is not a complete and final solution. It must, of course, be modified and improved by experience and to meet changing conditions. If the school were just being established with ample resources at its command, a better training for industrial careers could readily be devised, which, in the opinion of the report, would contain among other changes, such features as the following: (1) A longer school day, of not less than seven net hours of instruction; (2) more time devoted to shop work, not less than three hours per day; (3) smaller shop classes, not more than twenty to the instructor; (4) instruction in the electrical industries including the applications of power at least equal in the amount of time and equipment to that now proposed for each of the various shop courses; (5) instruction in foundry work.

(1) Business practice.
(2) Business organization.
(3) Applied economics.
(4) Shop organization.
(5) Problems in applied citizenship.

Instruction in these subjects, it has already been pointed out, is absolutely necessary to the kind of training which the School Committee wishes the school to give. Although civics is included in the course of study given in the school report, instruction in this subject follows the usual high school treatment and is not the kind of course recommended in this report. Suggestions concerning the character of the course in civics are to be found in Appendix B (page 75).

(d) *The controlling aim of the curriculum recommended in this report* is to fit for profitable employment and responsibility in industry, and each subject should be made to contribute directly to that end. The aim of the course in mathematics, for example, should be to enable the pupil to use mathematics in solving the practical problems that he will meet in the business of industry; the course in drawing should aim to teach him to interpret intelligently mechanical drawings as they are used in the industrial world and to make sketches and working drawings for commercial purposes; the aim of the course in science should be to equip the pupil with the knowledge and habit of scientific method as applied to industrial processes; and the shop work should aim to give him as a consumer an insight into commercial shop processes, shop organization and management, which shall enable him to make practical use of such information in solving the problems of his future work.

In contrast to these aims are those for the different subjects included in the present course, as given in the school report. It is there stated that "The main purpose of the mathematical course is to train pupils to habits of accuracy in thought and expression, and to give them clear notions of the value and convenience of mathematical processes in the investigation of practical problems." In both physics and chemistry, the aim of the instruction is "to awaken interest in scientific pursuits, and lay a good foundation for subsequent work."

In speaking of the aim of the mechanical work the school report says, "It is the aim of the mechanical department to

teach in a thorough and systematic way, the elements of carpentry, joinery, wood-carving, wood-turning, pattern-making, forging of iron and steel, chipping, filing, fitting, and machine tool work." At another point it is stated that "the training school . . . teaches the elements of mechanic arts primarily on account of their educational value, just as arithmetic and geometry are taught."

These aims, in common with the general aims discussed in an earlier part of this report, are aims of general education. Nowhere is there any specific statement of purpose relating to the various subjects given in the course of study which indicates that any subject is included because of its vocational value or is taught with a view to its practical application in industry.

(e) There is little or no industrial content in the various subjects as taught in the school, included in the course of study given in the school report. An analysis of the course in mathematics, for example, shows that it does not materially differ from the course in mathematics in any good general high school.[1]

While this course in mathematics is undoubtedly well adapted to preparing boys for the technical college it contains many topics that the future officer of industry will never need and omits entirely most of the topics recommended by this report. It is only fair to say that here and there in the school the writer found instruction being given in some of the topics suggested in the Appendix of this report, as supplementary to the regular course in mathematics. Such instruction was, on the whole, only incidental, and no well-organized plan of instruction along the lines herein recommended appears to have been worked out.

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[1] "The first year's work (in algebra) has special reference to the attainment of proficiency in the more important processes and extends through simultaneous quadratics. The second year's work is a review of the work of the preceding year and extends through progressions. Algebraic methods are employed in the solution of such problems as are met with in the study of physical sciences, and in the mechanical department of the school.

"During the second year the subject of plane geometry is completed. The first half of the third year is devoted to the principles of solid geometry and to numerous exercises illustrating and enforcing them, while the remainder of the year is given to plane trigonometry and reviews.

"The work of this year in trigonometry is designed to familiarize the student with the fundamental principles and formulae. The subject is continued in the fourth year with special reference to its application, to problems in surveying, navigation, and physical science."

It is also true that, in the case of certain other subjects, such as English, history, and science, instruction of an industrial character, supplementary to the regular course, is being given. In general it remains true that such instruction also is only incidental and that these subjects are not in any vital way correlated with industry and the work of the shop.

(f) A further difference between the two courses of training under discussion is the educational theory on which each is based. The present course of study is founded on the theory that every pupil is endowed with certain faculties like memory, reason, and judgment, and that to educate him you have only to train his faculties. These faculties once thoroughly trained in any field of thought give power that can be successfully transferred to any other field. The school report says, as already noted, that "the primary purpose of the school is to secure the harmonious development of all the powers of the pupil" and that "the training which it (the school) gives is not less valuable to a boy who is to become a lawyer or a physician than to one who is to superintend a manufacturing establishment or work at the bench." Again, in speaking of the course in mathematics, it says, "the aim is to train pupils to habits of accuracy of thought and expression." These statements indicate a belief in the value of formal discipline—a theory long since repudiated by most of the best psychologists.

In contrast to this theory of education the course of study recommended in this report is based on the theory that, in order to develop special capacity in any given field, such as that of productive industry, the pupil must be trained in that special field.

6. *On the whole, as has already been stated, the present course of study in the Mechanic Arts High School must be regarded as little more than a general preparatory course* for the engineering college. The aim and content of such subjects as mathematics, English, science, and history, it appears, do not essentially differ from the aim and content of the same subjects in the English High School. To a large extent, the two schools use the same text-books and the same methods of instruction. They set up the same limits of study in various subjects, their classroom instructors have the same qualifications, and both schools fit for the same engineering colleges. Even French is

offered in the Mechanic Arts High School for no other purpose than to enable the graduate to meet the entrance requirements of the engineering college, and the only reason Latin has not been included in the course would seem to be that there has not been a sufficient demand for it to form a class.[1]

The whole policy of the special schools for Boston is based on the different assumption that not only do secondary school pupils have different aims, aptitudes, and possibilities, but that to realize them, special schools, each with its distinct aim and course, are necessary. The course now offered by the Mechanic Arts High School, it has been clearly shown, does not agree with this policy.

In the field of higher education the old theory of formal discipline has been almost entirely discarded. No one to-day would think of claiming that the lawyer could be as well trained for his life work in an institution giving only a general training as in a modern law school, or that an engineer or physician could be best trained in a college of letters. Experience has shown beyond question the advantage of special training for special fields of work; and the principle applies with as much force in the field of secondary education as it does in the field of professional training.

Instruction

1. *When the School Committee, by official action, decreed* that the Mechanic Arts High School should be a special school for the training of officers of industry, it thereby set up, as has already been pointed out, certain requirements as to the methods and nature of the instruction to be given in this school, made necessary by virtue of the fact that it was a special school having a special aim.

2. *The methods of teaching used are not adapted to the preparation of boys for industrial careers.* This fact, it should be said in passing, is in no sense a criticism of the instructors at present

[1] "Numerous inquiries concerning the school have been made by parents who are anxious to give their sons the advantages of a thorough course in manual training, but who also desire to have them begin Latin when they enter the high school, as a part of their course in preparation for college. If such applications should be received in sufficient number to justify the formation of special classes, the question of making Latin elective subject throughout the course will be seriously considered." *Cat., 1901, page 23.*

serving in the school. It must be repeated that the school possesses an able corps of teachers whose work is unquestionably equal to that in any of the Boston high schools. Undoubtedly they are thoroughly well qualified to teach college preparatory subjects and, for the most part, the shop men, because of their wide experience in industry, are well fitted to train boys for industrial pursuits. It remains true, however, that, in view of the aim of the Committee, many of the requirements necessary to efficient instruction of the kind recommended by this report are not now met by the school. At a later point the question of instructors is further discussed.

3. *The shops must be run on a commercial basis, to prepare boys for the demands of industry;* they must be properly equipped; pupils must be taught individually or in small groups rather than by classes; the teaching methods of shop and classroom must be adapted to the aim of the school; and every instructor, through trade experience and industrial contact, must be qualified to give his part of the special kind of training the school is expected to confer.

The experience of the best industrial schools, as well as such institutions as Pratt Institute, Wentworth Institute, and Carnegie Institute of Technology, goes to prove that, if shop instruction is to be efficient as a means of training for industry, it must be so conducted as to result in a product that can be put to some practical use. In the case of the Mechanic Arts High School this product could be disposed of to the school department, or to other city departments, by an arrangement similar to that which now obtains between the Boys' Industrial School and the school department. While the amount of output from the shops would be small, a usable output is necessary, if for no other reason, to avoid the waste and misuse that results from breaking up the product or giving it away for private use. Furthermore, a usable product, practical in character, made in response to an actual demand, is the only way in which reality can be given to the shop training.

The shops of the school as a whole are practically non-productive at the present time. The list of all the different jobs completed in 1911–12, submitted by the headmaster, shows that not less than 70 per cent of them were exercises like those commonly performed in the conventional manual training school, consist-

ing of such things as: making a miter joint, a square joint, square prisms, flower trellis, coat hanger, carving an ink stand, carving a rosette, making flat rings, test pieces, brackets, staples, hooks, cylinder patterns, taper patterns, plugs, iron blocks, and shafts, as contrasted with the kind of "jobs" done by the methods employed in a commercial shop.[1]

According to records obtained in the school office, approximately 28,000 "jobs" were completed by about 1,400 boys in 1911–12, an average of about twenty jobs per pupil. This includes all jobs, exercises, and projects successfully done in the shops, including such things as sharpening lathe tools, fitting key to lock, grinding lathe centers, sharpening cutters, making staples, sharpening saws, as well as more important "jobs" and exercises.

Less than 25 per cent of the things made in the shops were put to use in the school, it being the practice to give most of the finished exercises or finished work to the pupil to take home, no charge usually being made for the material supplied entirely at public expenses. Nothing made in the shops with these 1,400 workers was either sold or utilized in the school department or other departments of the city as is done with the output of the shops of the Boston Industrial School for Boys. It should be said in justice to the school that many of the shop instructors are more than willing to undertake more practical work and have been planning to do so as soon as the shop classes have been reduced in size and the amount of shop time increased.

4. *The methods of handling the work should closely correspond to the best practice in commercial shops.*[2] The character of the product turned out in some of the shops, the fact that the stock in the wood-working shop, at least, is commonly gotten out by instructors and that the work is largely organized on an exercise basis, indicate that this is not generally true.

The best features of commercial shop organization in such matters as planning and routing jobs, checking and inspecting

[1] It is only fair to say that some of the "jobs" turned out in the various shops are of a commercial character. These, however, constitute only a small per cent of the total output of the school.

[2] In discussing the question of commercial methods, the headmaster says, "Commercial shop methods are always mentioned and explained in comparison with the simpler job methods by which the pupil is usually first made acquainted with the process, and frequently the commercial method of procedure is actually used in the school shop."

work, order systems, cost and production accounts, time accounts, records showing the movement of stock and jobs through the shops, the tagging and repair of incapacitated machines, and in the various other details of shop management should be employed wherever possible. To a limited extent, such things as time cards, job cards, and stock orders are now used. If the school is to instruct boys efficiently in the principles of shop organization and management, however, this feature of shop organization needs to be much more fully developed.

5. *Shop instruction in the best industrial trade and secondary technical schools* is usually given either to the individual pupil or to small groups. If the shops are run on a commercial basis, the diverse character of the work makes it impossible for the instructor to handle large classes. Experience goes to show that, under ordinary conditions, one instructor cannot efficiently handle more than twenty pupils in a shop class.

The shop classes are overcrowded. The records of the Mechanic Arts High School show that these accommodate from eighteen to forty pupils, dropping down to the smaller number only in the case of one or two divisions of the first year class near the close of the year and not going below thirty-one in the case of the fourth year class. The average shop class appears to be about thirty-four pupils while classes in elementary science have risen to eighty pupils. Judging from the statements in the catalogue, as well as from an examination of the plant, the drafting rooms and shops have been definitely planned and equipped with a view to accommodating classes of about that size.[1]

The headmaster also appears to be of the opinion that, on the whole, the equipment of the shops and the cost of material, as well as sound methods of pedagogy, justify shop teaching by groups rather than by individual instruction.[2]

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[1] That it has been the policy of the school to organize the work on the basis of large classes would seem to be evident from a statement in the catalogue which says, "to enable the largest number of pupils to enjoy the advantages of the school, it is necessary that each division should contain the maximum number for which the shops and the drawing rooms are equipped."—*Cat., 1904, page 56.*

[2] On this point the following questions were submitted to the headmaster: Question Number 11—If you use the group method of teaching, please give the reasons: (a) because the method is best as a means of teaching? (b) because the class is too large to be handled otherwise? (c) because the equipment is best adapted to the group method? (d) because otherwise too much material would be spoiled? (e) because best results are obtained after careful preliminary direction to the group? (f) Because immature boys learn best by the imitation?

In reply, the headmaster says: "The group method is preferred for all the reasons stated in Question Number 11."

While nothing in the headmaster's reply quoted above is said in regard to the size of the groups, the fact that the school is organized on the basis of about thirty-four pupils to the section and that no pupils have been refused admittance because the sections were too large for efficient work seems to indicate that the headmaster believes that large sections are necessary and can be successfully taught on a demonstration and imitation basis, which is the only method that can be used with sections of this size.

Leading psychologists, as well as practical shop men, are agreed that boys cannot be effectively taught shop work for any practical purpose on an imitation and demonstration basis alone, and that demonstration and lectures are valuable only as they are accompanied or preceded on the part of the pupil by actual participation in practical work. Where an instructor is obliged to handle shop classes of thirty to forty pupils he is forced to teach by lectures, demonstration, and imitation, and instead of using practical shop methods is compelled to organize his work on an exercise basis. Under these conditions the school fails to realize on the commercial experience of the shop instructor—the most valuable asset he brings to his work.

6. *In order to teach successfully the application of drawing, science, mathematics, and English to industrial work,* instruction in these subjects should be so organized that much of it can be given in connection with the shop work and at the moment it is needed. This can be successfully done by teaching pupils to make drawings, write specifications and reports, figure costs, and make shop calculations as a part of their practical shop work. This would greatly aid in bringing the necessary shop atmosphere into the classroom. To a very limited extent, instruction of this character is now being given in the school by requiring the pupils to make simple calculations and sketches, in the shops and in the classroom. This instruction, however, owing to the character of much of the shop work and the lack of systematic correlation between the work of the shops and that of the classrooms, is lacking in reality and fails to give the pupil the power he needs in practical application.

The instruction in related subjects referred to above should be supplemented by close and systematic correlation between the practical work of the shops and the regular work of the class-

rooms. Especially is this true of the work of the drafting rooms. A large part of the work done in this department should be in direct response to the needs of the shops. It does not appear that very much of the work turned out by the drafting department, excellent as it is, is now put to practical use in the shops.

7. *The regular school text-books contain but little material that can be used except for reference in classroom instruction* in such subjects as mathematics, science, economics, civics, and the like, in a course preparing for industrial careers such as those herein proposed. To a large extent the material for these subjects should be gathered from trade publications, the school shops, outside commercial plants, and similar sources. This makes it necessary to a considerable extent for the instructor to write his own text-books. These he can prepare in the form of mimeograph sheets and blue prints. The writer does not find this is generally done in the school at present. Teaching organized in this way is much more flexible and can readily be adapted to the needs of pupils and the demands of industry.

8. *As a further means of making such instruction effective,* the pupil should be required to visit outside plants and study, under direction, their business and shop organization and their methods of work. Representatives of such plants should be brought in from time to time to give special lectures on practical subjects relating to the affairs of productive industry. As elsewhere suggested, a plan should also be worked out whereby pupils should be required during their vacation to serve in commercial plants. The part-time class, elsewhere discussed in this report, is another and the best means of bringing an industrial atmosphere into the school. It does not appear that any of these devices are now systematically used in the school.

Instructors

1. The action of the School Committee in establishing a special aim for the Mechanic Arts High School has also imposed certain requirements as to the qualifications of the instructors.

2. *The instructors in charge of the shops should, as has been stated, be men of wide practical experience* in order to prepare "non-commissioned officers of industry." They should thoroughly understand their trade, both as to its practice and its

related technical knowledge, as well as the organization and management of commercial shops. In addition, they should also have had executive and business experience in the special fields for which the school is to train its pupils. They should have good general schooling and their personal qualifications should be such as to promise the efficient performance of their work. In addition to their personal and shop equipment, they should understand the aim and organization of the school and, in a professional sense, should know how to teach.

Shop instructors in the Mechanic Arts High School for the most part are well qualified to give the kind of instruction required by the aim of the School Committee, although, as has already been pointed out, the school is not now taking advantage of their practical experience.

3. *The teachers of related subjects should, to get the best results, have at least an elementary and practical experience in industry.* This would include instructors in such lines as mathematics, drawing, and science. Their experience need not be as extensive or as varied as that of the shop teacher, but it should at least be sufficient to equip them to teach their subjects in such a way as to enable the pupil to understand and use such teaching, within the limits of the aim of the school, in accordance with the best practice in industry.

Even the teachers of such subjects as English, civics, and economics should have sufficient contact with industrial activities to give them an appreciation of the conditions and problems of industry and at least a layman's knowledge of the more common machines and processes found in the shop. Their knowledge of industry should be such as to enable them to gather teaching material for their subjects from the world of work, and to make practical applications of the principles taught to the conditions and problems which the pupil as a citizen and a worker in industry is sure to encounter.

4. *A number of the present teachers of academic subjects have had no industrial contact whatever,* although they possess excellent preparation for the teaching of college preparatory subjects, and are, therefore, not qualified to give successfully the kind of training in related studies recommended in this report. Some of these teachers will doubtless be able to acquire the necessary industrial experience during their vacations. Others

probably could not acquire it, but they could be, in all probability, advantageously transferred to other schools.

Equipment

1. By establishing a special aim for this school, the committee has, by implication at least, set up certain requirements as to the general facilities of the school including the character and amount of the equipment.

A large part of the present equipment is admirably fitted for the best type of industrial work, if slightly rearranged and supplemented here and there by additional apparatus to increase the scope and variety.

2. *There is urgent need of more floor space for the shops.* Over 1,500 pupils are crowded into a building whose shops cannot properly accommodate more than about 800. Fortunately, however, more space can easily be found for shop uses by making alterations suggested on pages 64 and 84–85. On account of shops and laboratories a technical high school needs more space per pupil than does a general high school. While, for example, the space per pupil is greater in the Mechanic Arts High School than it is in the English High School, the shop floor space is less than that of the best industrial and trade schools and very much less than that of good commercial shops.

3. *This overcrowding appears to be due in part to a commendable desire* of the school administration to keep the cost per pupil down to a minimum.[1] This question of the per capita cost is discussed at length at another point. (See page 50.)

4. *Many of the machines are well suited to practical work.* In many instances, however, they should be rearranged so as to give more space for practical work, and they should be supplemented by other machines to increase the variety and scope of the instruction. At least two of the rooms now used for study

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[1] "To enable the largest number of pupils to enjoy the advantages with the school, it is necessary that each division should contain the maximum number of which the shops and drawing rooms are equipped."—*Cat. 1904, p. 56.*

In Appendix I of this report is given a table taken from School Document No. 12, p. 64, showing the cost of instruction from 1898–1904 to be less than that of either the English High School or the Public Latin School. In this connection the school report makes the following comment: "The impression that the school is still relatively expensive appears to prevail although that opinion rests upon no foundation in fact."

rooms should be added to the space now used for shop purposes and the machines and tools so distributed as to give sufficient space for productive work.

Contact with Industry

The school must, in a variety of ways, make systematic contacts with industrial life, in order, as has been stated at various points in this report, to adjust pupils to the practical demands of industry. It has also been shown that, on the whole, the course is academic and far removed from industrial and commercial life; that some of the teachers have never had any actual contact with industry; that the methods of instruction are those usually employed in schools dealing with general education and are not adapted to meet the specific demands of industrial occupations; that some of the equipment is not of a commercial character; and that, for the most part, throughout the school there is an entire absence of industrial atmosphere. This isolation of the school from practical affairs is perhaps best shown by its failure to establish any kind of working relationships with the industries in and around Boston into which, according to the aim of the School Committee, its students are to be sent with a working appreciation of the problems and questions with which these industries are concerned.

The lack of contact with industry is evidenced by such facts as the following:

(a) There is no organized or systematic plan of placing boys during the vacations in lines of employment similar to those for which they are being trained.

(b) There is failure to require experience of this kind as a part of the course of the school.

(c) No recognition in the way of credit is given a pupil for industrial experience.

(d) Visits to outside plants, when made at all, are only an incidental part of the instruction. There is no systematic, well organized plan of visitations.

(e) The school makes little or no attempt to bring in from the outside an industrial atmosphere by securing demonstrators, salesmen, employees, or other men engaged in the practical affairs of industry to give lectures on industrial questions and

shop problems as a part of the regular instruction of the school.

(f) Trade publications are not used for instruction purposes to anything like the extent they should be.

(g) There is no organization for the placing of pupils who graduate from the school or who leave before the end of the course.

(h) The school has developed no system for following up students after they go into the industry.

Each of these devices is necesssary as a means of vitalizing the work of the school and giving it that contact with practical affairs without which it cannot be efficient.

V

HOW FAR DOES THE SCHOOL SUCCEED IN PLACING ITS PUPILS IN THE KIND OF INDUSTRIAL EMPLOYMENT INTENDED BY THE AIM OF THE SCHOOL COMMITTEE?

It has already been shown that it is doubtful if more than from 25 per cent to 35 per cent of the pupils of the school go into industry on the business and directive side. (See page 24ff.) At a later point in this report, in connection with the recommendations herein made, the absence of any organized plan for placing pupils who leave the school either before or after graduation in appropriate employment in industry is pointed out and suggestions made as to how the school can best render this necessary service. (See page 59ff.)

VI

CAN THE MECHANIC ARTS HIGH SCHOOL SERVE AS A PREPARATORY SCHOOL FOR THE ENGINEERING COLLEGE AND AT THE SAME TIME REALIZE THE AIM OF THE SCHOOL COMMITTEE?

That the school successfully prepares boys both for industrial pursuits and for the engineering college, and that it should continue to prepare for the engineering college, it has already been shown, is the opinion of the headmaster.

The small proportion of pupils who actually enter productive industry either as skilled workmen or on the business and directive side, demonstrates that in attempting to realize the first aim the school has not in the past been notably successful. Neither has it been conspicuously successful as compared with other Boston high schools, in preparing boys for the engineering college. The school and college records show that, on the whole, boys find their way to the engineering college from other Boston high schools at least as readily as they do from the Mechanic Arts High School. (See Appendix A.)

During the past twelve years the Mechanic Arts High School has sent to the Massachusetts Institute of Technology, for example, an average of about twenty graduates a year as against seventeen from the English High School and twelve from other Boston high schools.

The table given in the Appendix of this report shows, moreover, that the records of the graduates of the English High School and the other general high schools of Boston, made at the Institute of Technology during this period, are superior to those made by the graduates of the Mechanic Arts High School.

It seems clearly evident that the school has not in the past been conspicuously successful in preparing boys both for industry and the engineering college.

The School Committee has defined the present aim of the school to be the preparation of boys for industrial careers. To

realize this aim the course of study and the methods of instruction, it has already been suggested and at a later point will be fully demonstrated, must radically differ from those now employed in the Mechanic Arts High School or in any school which aims to prepare for the engineering college.

If in the past the Mechanic Arts High School with its single course of study largely determined by the entrance requirements of the engineering college has been unable successfully to carry out this double aim, it is highly probable that, in the future, with a more highly specialized course of study directed away from the engineering college, it cannot hope to do so.[1]

It has been suggested that two separate courses be offered in order to meet this difficulty, one for the training of industrial cadets and the other for preparation for the engineering college. Even if separate courses were offered the two aims would directly conflict with each other. Attention would inevitably be given to one at the expense of the other. Owing to the radical difference in courses of study and methods of instruction, more or less duplication of equipment, instructors, and general facilities for the work would be necessary. This would undoubtedly largely increase the per capita cost of instruction beyond that of other preparatory schools. There is every evidence, moreover, that just as good results can be secured by using the other Boston high schools for all preparatory work.

In view of all the facts in the case there is every reason to believe that if the school should continue to offer preparation for the engineering college it must fail to achieve the purpose of the School Committee to make it a training school for industries.

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[1] The support for the idea that the school should prepare boys for the engineering college comes from the contention that the way to the college should be kept open at the top to every boy. In this connection these facts should be noted: (1) Less than one in seven of those who enter ever go to the engineering college. (2) There is no proof that any measurable number of these fail to reach a decision until late in their course. (3) Those who do so fail can get the necessary preparation by being shunted to other Boston high schools after they have determined to fit for college. (4) The present plan requires all boys to take the preparatory course for the engineering college whether they intend to go to college or not.

VII

IS THE PER CAPITA COST OF THE SCHOOL SUCH AS WILL REALIZE THE AIM OF THE SCHOOL COMMITTEE?

1. *The comparative cost of the different high schools* maintained by the city is given in a table in Appendix I of this report. Attention is here called to the low cost of maintenance of the Mechanic Arts High School as compared with the cost of operating the Girls' Trade School. The per capita cost of operating the Mechanic Arts High School is probably less than that of any special vocational school in the country and, it may be said in passing, furnishes one of the most conclusive proofs that it is a general high school.

The low per capita cost noted above has very evidently been brought about by policies which have undoubtedly been well meant, but which have seriously interfered with the efficiency of the school. They have resulted in classes much too large for satisfactory work, and have led to congested conditions that seriously hamper its success.

2. *The small amount of money expended for stock has also been a factor in the low per capita cost of maintenance.* In general, the cost for lumber, according to figures given by the headmaster, is less than $3 per annum per capita for boys in the wood-working classes. A boy can hardly be trained for efficient work in industry on such a small allotment of stock. The alternative, as already suggested, is to spend more money for stock and make a commercial product to be utilized in the school system or otherwise.

The recommendations made herein would undoubtedly increase the operating expenses to at least $100 per pupil, and even more according to the length of the school day and the size of classes. This type of education is expensive and if the Boston School Committee desires to have it, it must pay the cost.

3. *Causes of increased expenditure due to the recommendations of the report.* A part of the increased cost would be due to additional expenditures for changes in the plant and equipment, but almost all of it would be directly chargeable to operation and would be due to such items as the following:

(a) Increase in cost of instruction per pupil due to limiting the size of all classes to the number that can be effectively taught.

(b) Increase in floor space per pupil necessary to carry out the shop work.

(c) Increase per pupil in overhead and fixed charges of maintenance, such as light, power, heat, depreciation in equipment and plant, etc.

(d) Increase in the clerical and administrative force necessary to take care of the admission of pupils and the maintenance of a placement bureau.

(e) A small but necessary appropriation for special lectures by experts in practical subjects.

(f) Increase in the cost of material, which will probably be more than offset by the value of the finished product.

(g) Increase in the length of the school day, thereby further increasing such items as light, power, heat, repairs, and service.

It should be noted that in the estimates given below, while the cost per pupil per annum will be somewhat increased over the present cost, owing to the lengthening of the school day, the cost per pupil hour will not be proportionately increased. In other words, part of the increased cost will be due to the fact that the city, if these recommendations are adopted, will be buying more hours of training than heretofore.

4. As has been pointed out elsewhere, the per capita cost of instruction at the Mechanic Arts High School is, and has been for a considerable number of years, about $88. The very pertinent question arises as to what effect the recommendations herein made would have upon this cost. There are a number of considerations to be taken into account in making any estimate of the increase in expense due to the proposed changes and any statement on this point must, of necessity, be more or less tentative and conditional.

It is proposed to reduce the attendance upon the school from 1,500 to 1,200 pupils. Assuming that the total school attendance of the city remains stationary, it would be necessary

for the School Committee to find accommodations for approximately 300 pupils in other Boston high schools. All of these pupils could readily be taken care of in the various suburban high schools. It might be necessary, under the circumstances, for the School Committee to require the attendance of certain pupils living in outlying districts upon the high schools of such districts. This would involve a change from the present policy which permits all children, wherever located, to attend the high school of their choice.

In this connection, attention is called to the fact that at an early day the High School of Commerce will move into a new building leaving its present quarters available for use for high school purposes of any kind deemed advisable by the Board, thus affording accommodations for more pupils in the city of Boston proper, should this be found necessary.

It is also well to point out here that, since the per capita expense at the Mechanic Arts High School is greater than at practically all the other Boston high schools, the transfer of pupils seeking either a general high school education or preparation for the engineering college, from the Mechanic Arts High School to other Boston high schools, would reduce the cost of instruction for such pupils and, to some extent, offset the increased cost of operation of the Mechanic Arts High School under the new plan.

5. It is assumed in the figures which follow that the lengthening of the present school day from six to seven gross hours and thereby to six net hours for instruction is to be accomplished without increasing the pay of teachers or the number of teachers on this account. This means, in other words, that the present corps of instructors would be expected to teach about one more period per day.

It is well to point out in this connection that the total number of hours of instruction required from the teachers of the school will even under the recommendations herein proposed be much less than that now given by the teachers of the Boston Boys' Industrial School and the Boston Trade School for Girls.

At the present time, an average of approximately thirty-four pupils to the class is being taught at an expense of $88 per pupil. If the classes were reduced to twenty-eight pupils, the number of teachers required to take care of the same enrollment would be increased about 17½ per cent. This would raise the per capita

cost from $88 to $103.40. If the number of hours of instruction for each teacher were not increased with the lengthening of the school day herein proposed, there would also be necessary an addition of about 20 per cent to the teaching force in order to handle the same number of pupils. If we add 20 per cent of $103.40 there would be a new per capita cost of approximately $124.

In like manner, assuming no increase in teaching force or salaries on account of the lengthening of the school day, the per capita cost would be about $114.40, if the classes were reduced to not more than twenty-four pupils. So, in the same way, should the classes be reduced to twenty pupils, the per capita cost would be about $125.

It should be pointed out here that in the above estimates no allowance is made for a variable factor due to certain fixed charges, such as supervision, heat, light, printing, and clerical hire, the gross amount of which, and, therefore, the cost of which, would probably remain about the same as in the present school with its 1,500 pupils. A reduction of the total enrollment of the school to 1,200 would only slightly reduce these fixed charges and, therefore, slightly decrease the above estimates as to the expense per pupil of operating the school.

VIII

IS THE ADMINISTRATION OF THE SCHOOL SUCH AS TO PROMISE A REALIZATION OF THE AIM OF THE SCHOOL COMMITTEE?

1. *The difference of opinion as to the aim of the school* between the headmaster and the School Committee is taken up here with reluctance. Whatever may be said by way of criticism of the present work of the school it must be recognized that manual training throughout the country is undergoing a period of readjustment and that some of the criticism made against the school arises from this fact, and would be equally true of any manual training high school. It is also true that in any school situation there are inherent in the problem certain factors that are wholly beyond the control of the executive. In the light of these facts it is clear that the headmaster cannot be held answerable for every adverse finding made in this report. Neither should it be forgotten that for many years he has rendered to the city distinguished services of large value. In the administration of the Mechanic Arts High School he has shown himself to be a teacher of rare insight and an executive of unusual ability. Abundant credit should be given him for the tact, the skill, and the incessant labor which has been necessary to bring the school to its present point of development.

2. *The headmaster has been the storm center of the discussion* that for the past ten years has been waged about the work of this institution. During that time there has been decided disagreement between him and the Boston School Committee as to the policy and purpose of the school; so much so that at times they have worked at cross purposes with each other. The evidence of this report goes to show that not only is the school failing to carry out the aim of the School Committee, but that there continues to exist between the School Committee and the headmaster a wide difference of opinion as to what the school should be and do.

This report is in no way concerned with the merits of this controversy. It is thoroughly appreciative of the honesty of opinion and purpose of all concerned, but it should be pointed out here that this difference of opinion has not, to say the least, contributed to the efficiency of the school and does not promise the best results in carrying out the aim of the Committee.

3. *The time has come for a clear and definite understanding* between the School Committee and the headmaster which shall finally decide beyond the possibility of future misunderstanding, the policy of this school. It seems clear that at the earliest possible moment a friendly conference should be held by the School Committee with the headmaster for the purpose of reaching an understanding on such points as these: (a) Does the Boston School Committee still decide after reading this report that the Mechanic Arts High School shall hereafter no longer be a preparatory school for the technical college, but a finishing school training for important positions in industry? (b) Does the present School Committee accept as a general policy the recommendations of this report? And, if not, what modifications of the same should be made? (c) Does the headmaster find himself able to accept the policy for the school resulting from the above decision of the School Board? (d) If not, what exceptions does he take to the decision of the School Committee? What is the final decision of the School Committee with reference to such exceptions?

It is hardly necessary to suggest that these conferences should deal with broad matters of policy and not with small controversies and details of administration. In making any decisions based upon this report it should be recognized that the discussion and recommendations contained herein deal with the problem from the standpoint of principle and by way of suggestion. It is understood, of course, that the task of working out the details of any plan that might be adopted would have to be left to the headmaster and his assistants.

4. *Should the headmaster find himself unable for any reason to agree fully with the policy of the Committee as expressed in their final decision,* he will doubtless be only too ready to ask, and the School Committee willing to grant his request, that he be assigned as headmaster of some other Boston high school, with whose work he finds himself in accord, in a way in keeping with the distinguished and devoted service he has rendered the city.

RECOMMENDATIONS

RECOMMENDATIONS

Certain thorough-going changes must gradually be made in the methods of selecting pupils, in training them after being selected, in placing in employment those who receive the training, and in following up during employment those so placed in order to test out the effectiveness of the selection, training, placement, and employment.

The school is not prepared to make all the necessary changes at once and an opportunity should be given the teachers to study the situation. Justice to the boys who have entered the school on the present basis, moreover, requires that they should be allowed to finish undisturbed the course on which they have entered. It is, therefore, recommended that the classes now in school be allowed to graduate on the present basis and that no changes be put into effect until September, 1914, such changes to begin with the class of 1918.

Because of the imminence of the next school year, we have undertaken to deal in some detail with the immediate changes to be made in the first year work. These changes are given in Appendix D of this report.

The remaining changes which this report will recommend are discussed in more general form in Appendix B, time and experience being required to work out the details of the later years. As the reorganization of the school develops, there will be plenty of opportunity to do this.

1. *Recommendations as to methods of finding the group* to be trained. At the present time graduates of the grammar schools find their way from these schools to the various high schools of the city in a haphazard fashion. They go to such institutions as the Mechanic Arts High School, the High School of Commerce, or the Girls' School of Practical Arts, for a variety of more or less accidental reasons. A particular school is selected because it is near at hand, or is attended by friends, or is recommended to be good, or because the pupil has been advised to go to it. To some extent the vocational counselors in the grammar schools

and some principals are endeavoring to help in this important work of educational and vocational guidance.

If Boston is to operate a number of special high schools having different aims and different courses of study it must set up the machinery necessary to secure from the elementary schools the proper product for the various high schools. To have the right kind of raw material to work on is just as necessary for a school as it is for a factory.

To accomplish this purpose adequate means should be provided for the educational direction as well as the vocational guidance of grammar school pupils. Such guidance should properly begin with direction to the right kind of school of higher grade including, of course, the Industrial School for Boys, the Trade School for Girls, and the continuation schools, as well as the various high schools. Guidance should include not only placing in a high school, but also the transfer of those pupils who are found to be misplaced.

As the first step in such a program the School Committee should set up a clear definition of the aim of each school, both general and special, in terms of the vocations, or the avenues to vocations, to which each leads. These definitions should then be legislated into the educational policy of the School Committee, subject to change as the necessity arises.

The aim of each school having been defined there should be organized a committee on vocational guidance to serve as a clearing house on all matters that have to do with the guidance of grammar school pupils to the various other schools, their admission to such schools and their transfer from one to another.

Such a committee might well be directed by one of the assistant superintendents of schools detailed for the purpose, and might consist of the vocational counselors or the principals of the various high schools, or both, and the vocational counselors or principals of the grammar schools.

In order effectively to perform its work the committee on vocational guidance might well put into operation such plans and devices as those discussed in Appendix H of this report. In addition to these measures, and others commonly practised by vocational counselors, it is recommended that there be made an analysis of various occupations and their requirements, and the preparation offered by different schools; and that the

results be charted for use in the various grammar schools. Such an analysis has been made by the school department of Los Angeles, of the different occupations and the preparation for them offered by the various schools in that city. Attention is also called to the talks on various vocations given in the schools of Winnipeg by men outside the schools. These talks are printed for distribution to the pupils.

An important responsibility of the guidance committee would be the transfer to other schools of those pupils who were found to be misfits. This would not only necessitate frequent conference between parents and teachers, but also careful observation of the work of the pupil during the first few weeks in the school, both before and after his transfer.

It should also be the duty of the committee to see that the pupil transferred from one school to another secured in the new school favorable entrance in regard to such matters as proper credit for work done, assistance in adjusting himself to his new environment, and a reasonable period of trial.[1]

2. *Recommendations as to the training to be given.* It has clearly been demonstrated that the Mechanic Arts High School is neither necessary nor desirable as a preparatory school for the engineering college. This report, therefore, recommends that the school give up any attempt to fit boys for such institutions, and confine its training to the preparation of boys who, on graduating from the school, intend to go directly into industry on the business and directive side.

To this end it is recommended that the present course of study be abolished year by year and that a new course be organized in accordance with the aim of the School Committee.

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[1] While this report recommends that pupils who wish to fit for the engineering college be not admitted to the school, if they are admitted, they should be required to take for two years the same course as other pupils and at the end of that time be transferred to the English High School or other Boston high schools to complete their college preparation. In this way the interests of those boys who, after being admitted to the school wish to prepare for the engineering college as well as those who plan to go directly into industry, will be best served.

If, in order to carry out this recommendation, it should be necessary to enlarge the facilities of the English High School, this can be accomplished with greater ease and at less cost than any other plan for accommodating those pupils who seek preparation for the engineering college. Some time ago a similar plan was proposed by the headmaster as a possible method for preparing boys for the Classical College in conjunction with the Mechanic Arts High School. (See report of the Mechanic Arts High School, 1901, pp. 23–24.)

The immediate aim of the course should be to develop in the pupil an appreciation of the problems and quantities involved in manufacturing and the capacity to "size up" and deal in classroom, laboratory, and shop, with the kind of situations that present themselves in productive industry.

As already noted the course should include instruction in English, mathematics, drafting, science, industrial history, applied economics, citizenship, business organization and practice, shop organization and practice, and practical shop work in wood, metal, and power. All other subjects now in the course of study should be omitted. The subjects mentioned above are more fully discussed on pages 28 to 37 of this report, and in Appendix B is given in more or less detail suggestions concerning the scope and character of the subject matter. It is recommended that the content of the various subjects be worked out along the lines suggested throughout the report.

The course should be four years in length and, with the exceptions noted below, the same work should be prescribed for every boy. In general the time should be about equally divided between practical shop work instruction in applied science, drawing, and subjects directly related to the shop work and instruction in the other and more general subjects of the course, one-third of the time being given to each.

There should be at least six full hours of instruction in the school, not less than two of which should be given to shop work. It should be pointed out in this connection that a longer day with a corresponding increase of shop time would undoubtedly produce even better results. In the fourth year, a pupil interested in some one industry common to Boston, might well be allowed to specialize in that industry and, wherever possible, give a part of his time to partial employment in that occupation, which employment shall be credited in the school.

The methods of instruction which this report recommends have already been discussed at some length on pages 37 to 42. Further suggestions as to method are given in Appendix C.

3. *Recommendations as to employment and vocational guidance.* One of the most important responsibilities of the school is the placing in employment of its graduates and those who leave the school before completing the course. To market its product and do it properly is as much the business of a special

school as it is that of an industry. The only way in which the school can get any adequate measure of the efficiency of its training, moreover, is by the success in industry of the boys whom it sends out. This not only requires that pupils shall be properly trained, but that they shall also be assisted to advantageous employment.

It is, therefore, recommended that there be organized within the school a bureau for the placing of pupils. This bureau might well be in charge of a vocational counselor employed for the purpose or of some member of the faculty who possessed special qualification for the work and who had been sufficiently relieved of his regular teaching to allow him to attend to his new duties. The director of the bureau should have at his disposal all the clerical assistance necessary and he should be further assisted in the discharge of his duties by a committee from the faculty acting mainly in an advisory capacity. From time to time he should also seek the assistance and advice of the general advisory board to the school. In this connection attention is called to the fact that the rules and regulations of the school committee for the Boston Trade School for Girls provides for a vocational assistant for each 150 pupils.

It should be the business of the placement bureau to handle all business that has to do with the guidance and placement of boys on leaving the school. This would include such things, among others, as the following:

(a) Keeping records of such matters as:
  The boy's school history and experience, including the data obtained at the time of entrance by the school from the vocational guidance committee in the grammar school.
  The economic conditions of the home.
  Health, eyesight, physical defects.
  Mechanical, executive, and business ability, so far as these can be determined.
  General characteristics.

(b) Visits to the pupil's home.

(c) Visits to his place of employment.

(d) Conferences with the boy, with his parents, and with his employer.

(e) Analysis and charting of various occupations, especially as to health requirements and also the reaction of the employment upon the pupil's health.

(f) Records and information as to market conditions with respect to the kind of labor the school is endeavoring to market.

(g) Advertising the school's product.

(h) Enlisting the interest and co-operation of employers in placing boys.

(i) Follow-up records of boys after they have entered the industry, in order to determine such things as: Increase in wage, conditions of employment, causes of failure, and what modifications, if any, appear to be necessary in the training given. These data are also important as guides for future placement.

4. *Recommendations as to equipment.* This report cannot go into detail as to the alterations that should be made in the shop equipment, but some of the more important changes follow. In order that shops may properly serve the aim of the Committee much of the present duplicated equipment should be removed. The smaller lathes in the machine shops should be supplemented by heavier lathes, milling machines, drill presses, planers, and grinders. Many of the benches should be taken out ofthe woodworking shops in order to provide necessary working space. Forging should be carried on in close relation to the work of the machine shop. To do this some of the forges now in use should be disposed of and the space thus gained used for subsidiary machines.

Every facility of the power plant in the school, including the engine room and the boiler room, should be used for practice training in power and applied science. Additional power equipment, for experimental and demonstration purposes, in the form of gasoline engines, small steam engines, steam pumps, and generators, should be installed and more or less equipment of a commercial character should be added to the science laboratories. A suitable shop should be furnished for printing and the present equipment greatly enlarged. There is ample room in the building for this purpose.

Wherever possible a drafting room and a recitation room should be provided in close proximity to each shop in order more readily to effect a close correlation between the shop work and the related technical work. To gain the necessary room for this purpose space could be taken in the recent addition to the school building, now used almost entirely by academic

classes, for some of the science laboratories, and, if structural reasons do not prevent, for wood-working shops.

5. *Recommendations as to part-time instruction.*

(a) Attention is here called to the large possibilities that present themselves in training for industrial careers through part-time classses in which the employed pupil, by an arrangement similar to that now practised in many industrial schools, spends from ten to fifty per cent of his working time in the school. This plan would give him an excellent opportunity, while at work, to gain valuable practical experience in the various phases of business as applied to manufacturing as well as insight into shop processes. The experience thus gained, the school would supplement by classroom instruction in related subjects of the character discussed in the Appendix of this report. (Appendix B.)

(b) All the arguments commonly advanced in support of the part-time school for trade workers apply here with even greater force. Such a plan would afford a means of utilizing the expensive equipment of the school and the building to its fullest capacity, it being possible to use them, not only during regular school hours, but also during the time the regular school is not in session; it would hold in the school many boys who, for economic reasons, now drop out before completing the course; it would keep the school in touch with industry and bring to it an industrial atmosphere to a degree not otherwise obtainable; it would materially reduce the cost of training many pupils; and it would make possible training in certain lines, like the manufacture of boots and shoes, which because of the character of the industry, might not otherwise be possible within the school.

This part-time arrangement might be of either or both of two different kinds. Boys in the industry can be brought to the school for class instructions. Boys in the school could be received into the industry to get commercial experience.

Doubtless many employers in and around Boston would be found ready and willing to co-operate with the school in a scheme of this kind. At the present time the Mechanic Arts High School carries on no part-time work of any description. This report recommends that at an early date, steps be taken to establish part-time work of the character here suggested.

APPENDICES

APPENDIX A

THE MECHANIC ARTS HIGH SCHOOL AS A PREPARATORY SCHOOL FOR THE TECHNICAL COLLEGE

It has been pointed out in this report that the Mechanic Arts High School has been used as a preparatory school for the engineering college on the theory that it was necessary or desirable as such. This theory is not borne out by the evidence.

In the report of the Massachusetts Institute of Technology for 1911 is given a table setting forth the records in that institution made during the past twelve years by students who have received their preparatory training in the various high schools in and around Boston. This table follows:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Standing of Students in Certain Preparatory Schools

	Number Entering	Per cent Graduating	Per cent of Failures. (This includes all who left in poor standing.)	Standing of Students who graduated indicated by the deviation from the average on an arbitrary scale; + means above the average and — below the average.	
				During first year	During whole course
Boston Public Schools...	577	53	36	+6	+2
A					
English High.....	200	61	28	+16	+2
Mechanic Arts High...	234	45	44	—22	—3
B					
Brighton High... 9 Charlestown High 8 Dorchester High..27 East Boston High. 15 Roxbury High....40 South Boston High 4 W. Roxbury High 5	108	50	38	+16	+3
C					
Girls' High.....	13	69	31	+149	+58
Latin (Boys).....	22	73	23	+11	+2
C.....	35	71	26	+61	+12
B and C.....	143	55	35	+30	+9
Suburban Schools.....	407	61	31	—8	—3

From an examination of this table it appears that the best preparatory school for the Massachusetts Institute of Technology is the Girls' Latin School. The others graded in order of merit from this standpoint are: The Boys' Latin School, the English High School, the General High Schools, and the Mechanic Arts High School.

It is apparent from these figures that the English High School is preparing very nearly as many boys for the Institute of Technology as is the Mechanic Arts High School, and that it is doing it more effectively. The pertinent question arises: Why duplicate its work?

It is also evident from this table that all the other general high schools of Boston are offering adequate preparation for the Institute of Technology. If the Mechanic Arts High School were to discontinue its preparatory course for the engineering college it would be comparatively easy for a boy to obtain the necessary preparation elsewhere. Under these conditions it would seem as if the burden of proof rests upon the Mechanic Arts High School to show that it is either necessary or desirable for it to offer preparation for the Massachusetts Institute of Technology or any other engineering school.

It must be admitted that the table referred to above is based upon the records made in one institution only and that it would be unfair to draw hard and fast conclusions from these data. Nevertheless, it is significant as indicating that the manual training high schools and the technical high schools have not as yet demonstrated any superiority over the regular high school in preparing boys for the engineering college.

This position is further supported by the dean of the Engineering School at Tufts College and ex-President Hamilton of Tufts College, who express themselves as being satisfied with the kind of preparation offered by the general high school, and who also say that training in shop work is practically valueless as a preparation for the engineering college unless such work is closely correlated with physics, mathematics, and drawing.

Based upon considerable discussion with the presidents and members of the faculties of various engineering colleges, this report offers an explanation of why the general high school is more successful as a preparatory school for the engineering college than are schools like the Mechanic Arts High School.

It is admitted that this explanation only represents the opinion of the writer and is not based upon sufficient evidence to be conclusive.

Taking the engineering colleges of the country as a whole, it may be said without fear of successful contradiction that they are seeking the student with the same type of mind as is the college of liberal arts. Both institutions are looking for the man who has the capacity to deal with abstractions on paper. The only difference in the kind of work done by these two institutions is in the subject matter studied. Both are training the students to think, on the whole, in abstractions; at the engineering college, in the field of physical phenomena, at the college of liberal arts, in the field of social and mental phenomena. The subject matter with which each deals is different, but the process is the same, and the kind of mind required to carry on the process successfully in both cases is the same. It is true that the engineering college expects the graduate to deal with practical problems, but it holds that, in order to do this, he must have the capacity to master in the school as organized knowledge the theory lying back of such problems.

The engineering school, therefore, lays its emphasis upon the two tasks of selecting the man with the power to do its work and of teaching the theory underlying engineering problems.

Abundant evidence that the engineering college wants the same type of mind as the college of liberal arts is found in the fact that in general, with the exception of Latin and Greek, both institutions set up essentially the same kind of entrance requirements; they use the same methods of testing applicants for admission and the same methods of appraising the results of the examination; they give little or no credit to any form of practical experience and, on the whole, the candidates who can successfully meet the entrance requirements of one institution can with equal success meet those of the other. Further evidence is also found in the fact that both the engineering colleges and the classical colleges accept for entrance the examination tests of certain college entrance boards.

When a city like Boston adopts the policy of special high schools and establishes a system of free choice of schools by pupils, most of those children having, in the main, the greatest interest in books and the largest capacity to deal with abstractions, will

find their way to such high schools as the Latin schools, and to certain courses, at least, in the English High School. On the other hand, most of those pupils who are "concrete"—rather than "abstract-minded," and who gain knowledge most effectively when coupled with manual work, will find their way to such schools as the High School of Practical Arts, the Girls' Trade School, the High School of Commerce, and the Mechanic Arts High School.

An examination of the grammar school records of pupils who enter these schools shows this to be true. The headmaster of the Mechanic Arts High School also appears to concur in this opinion.[1]

Furthermore, all the time given to shop work in the Mechanic Arts High School not only receives practically no recognition from the Engineering School, but represents time taken away from the academic studies which the School does require and upon which it tests the candidate for admission. The school day is practically the same length at the Mechanic Arts High School and at other Boston high schools, like the English High School. About one-third the time at the Mechanic Arts is given to shop work. This means that the pupils of the school have only about two-thirds of the time for classroom instruction in studies preparatory to the Engineering School which the pupils of other Boston high schools receive.

Under these circumstances, it is not strange to find a larger proportion of students from the other Boston high schools than from the Mechanic Arts High School making successful records in the Engineering School. This is in no sense a reflection upon the many creditable students from the Mechanic Arts High School who have graduated from the engineering college, nor upon the character of the instruction offered in the Mechanic Arts High School, but is rather an explanation of why under the present standards set up by the Engineering School, at least, it is erroneous to assume that such an institution as the Mechanic Arts High School is needed to prepare boys for it.

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[1] "The boy best adapted to meet the demands of the Massachusetts Institute of Technology has been rather more likely to go to other schools, particularly the English High, than to the Mechanic Arts High School."—*Replies to questionaire by the headmaster, Appendix E.*

APPENDIX B

SUGGESTIONS CONCERNING THE COURSE OF STUDY

The following lists of topics are intended to be suggestive merely. They indicate the direction in which the different subjects to be taught should be developed. No attempt is made to name the various topics in order of their importance or with reference to the relative time to be given to each.

1. *Business practice.* The pupil should be trained in the elementary principles of business procedure. In order to meet immediate and future demands on the business side of his calling, he should be taught in the school such things, among many others, as the following:

How to draw a check.
The meaning of debit and credit.
How to make a bank deposit.
How to file letters.
How to write telegrams.
How to handle business over the telephone.
How to draw notes and bills.
How to draw specifications and bids.
Office rules and regulations.
Office organization.

2. *Business organization.* When the boy enters industrial life he needs to be equipped with an elementary knowledge of how business deals with questions of its own organization. This equipment might be represented by many such things as:

The organization of a company.
The issuing of stocks and bonds.
The borrowing of money and issuing of credit by banks or manufacturers.
The drawing of contracts.
The organization of the business force from the board of directors to the office force, including such questions as the proper assignment of powers and the distribution of responsibility.
Inspecting, auditing, and accounting.
Salesmanship, including the organization and direction of the selling force.
The campaign for foreign markets.

3. *Applied economics.* On leaving the school the boy is going out into industry where he will be brought in close contact with the economics of production. He, therefore, needs an elementary knowledge of applied economics such as might be represented by many such things as:

Accidents in industry.
Factory regulation for Massachusetts.
Employers' Liability and Workmen's Compensation.
The history, status, and purpose of trade unions.
Equitable relations between capital and labor.
The health of the worker.
The minimum wage.
The I. W. W. movement.
Co-operation and profit sharing.
Raw materials, wages, and credit.
Laws of supply and demand.
Sources of raw material.
Marketing of products.
The selection and training of workers and social welfare work in industry.

4. *Industrial and general history.* Every young man facing life needs to understand the significant events of the past that have led to our own age. The best thought of our day has come to recognize that this knowledge can best be given to him, not through the meaningless recital of the wars and amours of kings, but through the study of events as the result of deep-seated economic causes, out of which all social and political changes have evolved. The history taught in the school, even when it deals with the remote past, should have a distinct economic bias. It might be said in passing that this method of approach in the teaching of history is approved to-day, as being the soundest and most effective.

It is especially necessary that the intelligent young man entering upon an industrial career, being concerned, as he will be, with the wider phases of its economic and industrial activities, should have as a background a thorough understanding and appreciation of the great economic movements of our history, from which have resulted our present commercial and industrial organizations and practices.

In addition to the general history above described, he should know such special aspects of history as the following:

The history of industry in New England.
The history, causes, and effects of specialization in industry.
The history of the evolution of industry.
The history, status, and purpose of trade unionism.
The history of the changing ethical basis and relationship of capital and labor.

5. *Shop organization.* Since the "non-commissioned officer" is to deal in one capacity or another with the problems of the commercial shop, he needs training in shop organization. Instruction of this kind should be given in the classroom through text-book study, by study of the school plant, through lectures by experts from outside shops, and by visitation and special study, under direction, of outside plants. This training should include the study of such things as the following:

The purchase of raw materials and equipment.
Local markets for the purchase of raw material and the distribution of the finished product.
The selection and arrangement of equipment.
The adaptation of plant.
The selection and use of power.
The routing of materials through shops.
The organization of the stock room and the tool room.
Practical methods of selecting, training, and managing workers.
Methods of safeguarding against accidents.
Shop sanitation, light, and hygiene.
Scientific management, its field and its limitations.

6. *Citizenship.* Both as a future citizen and a prospective industrial worker, the pupil should have an elementary practical knowledge as contrasted with an academic knowledge of the problems involved in civic affairs with which his life and work are certain to be connected. The following are illustrative of the many things he should be taught:

The levying and collecting of taxes.
Factory regulations and labor laws.
How a city conducts its business so as to safeguard against contagious diseases, polluted water supply, contaminated food, unwholesome milk, fire, sewage, crime, and accidents.
How a city uses the contributions of science to promote the well-being of the citizen.
How to vote.
Responsibility of the citizen for the welfare of his neighbor.

How the city deals with such problems as the following: electing its officers; making and enforcing laws; collecting taxes; expending revenues; safe-guarding life, limb, property, and morals.

How the state organizes itself to accomplish the above mentioned purposes.

How the national government deals with such problems as the following: conservation of physical and human resources; immigration; the securing of good servants; securing of revenue.

7. *Science.* Success in modern industry requires a working knowledge of the use of science, particularly physics, chemistry, and electricity as a branch of physics, in their application to such things as:

Strength and properties of material; design, construction, and operation of tools, machines, and engines; the generation, distribution, and consumption of power; the construction, sanitation, ventilation, and lighting of buildings; the manufacture of special products; the utilization of by-products and waste; modern means of transportation and communication; the properties, production, and use of fuels like coal, oil, and gas; the manufacture, distribution, and consumption of light; the properties; production and use of building material like cement, concrete, tiling, stucco, brick, and structural steel.

To meet this need the Mechanic Arts High School should give a four-year course of instruction. The first year should deal in general with simple mechanics and the properties of materials; the second year in general with the development and application of heat, light, and power, including steam, electricity, and gas; the third year in general should give instruction in industrial chemistry and the strength of materials. The fourth year's work should aim to unify and organize the more practical experience of the previous years. It should also give more advanced instruction of an intensive and quantitative character in mechanics, industrial chemistry, and power, and should equip the student with an understanding of the theory and law lying back of the physical and chemical phenomena encountered in his previous study.

8. *Mathematics.* This course should be a finishing course and should aim to give the pupil a command of those parts of the subject he will need as a working tool in his business and as a part of his equipment to meet opportunities for promotion and the

changing requirements of industry. He should have the power to use mathematics in its application to such questions in industry as the following:

How to figure costs of raw materials, transportation, fuel, wages, power, waste, advertising, selling, collections, insurance, depreciation, taxes, miscellaneous losses, profits, dividends and interest, fuel values, horse power and efficiency of engines and machines, repairs and construction; how to solve trade problems involving such things as indexing, change gears, speeds, and feeds, taper turning, belting, shafting, speed indicators, electrical line losses, heating surfaces, indicator cards; how to take off quantities from plans and specifications; how to figure the strength of building materials; how to keep such records as timebook, stockroom account, payroll, and simple office accounts; how to use tables of all kinds dealing with logarithms, strength of materials, square root, interest; how to use other sources of mathematical information in handbooks, catalogues, order and discount sheets; the proper use and interpretation of graphs and diagrams; the use of mathematical instruments such as slide rule and planimeter; the applications of mathematics to the mechanics of machine design and building construction.

The instruction in mathematics referred to above might well cover the first three years of the course. This should be followed by a course which aims to organize and systematize the applied mathematics with which the pupil during the preceding years has been dealing and to give him some insight into mathematics as an exact science. Throughout the entire year, the work in mathematics should be intimately related to the practical work of the shops.

It is expected that this instruction would involve the teaching of such mathematical methods and concepts as the following: a review of such arithmetical processes as decimals, fractions, square root, percentage, etc.; the mensuration and construction of plane figures; the fundamental algebraic processes; the meaning and manipulation of formulas, linear and quadratic equations, exponents and roots, rates and proportion, the recognition of geometrical figures, similar plane figures and similar solids.

No attempt is here made to lay out the work by years, as the order in which the different topics should be taken up depends

more upon the shop, the engine room, and the laboratory work than it does upon the mathematical sequence of such topics. In general, the instruction of the first year might well throw the emphasis on the arithmetical phases of the work, in the second year on the algebraic, and in the third year on the geometrical. No hard and fast line, however, should be drawn between the instruction of the separate years.

9. *Drawing.* A graduate of the Mechanic Arts High School will not usually be a professional draftsman. His use of drawing will for the most part be that of the intelligent consumer rather than the designer or the producer of finished working drawings. On the other hand he must in addition be able to use drawing as a tool in the accomplishment of practical work and as a means of representing his ideas in a clear and accurate way. The knowledge he requires might be represented by many such things as these:

Ability to make free hand sketches.
Ability to draw to scale.
The making and tracing of blue prints.
Reading and checking blue prints and taking off quantities.
Making drawings from specifications and specifications from drawings.

In order to be able to deal with the architect, the engineer, and other technical experts on an intelligent footing, he should understand in what way drawing is a factor in the shop, in building construction, and in technical work. To this end he should have practice in the interpretation of blue prints in the shop and in outside construction work. He should also be able to understand erecting erecting-plans for machines and engines and for the installation of heating plants and power equipment.

10. *Practical shop work.* It would be impossible to give shop experience in very many of the different lines of industry carried on in Boston and vicinity. It will, therefore, be necessary to choose a few lines of work having well standardized practice and well established systems of organization, which at the same time will afford the best opportunity to teach the pupil, so far as the limitations of the school will permit, the way in which modern manufacturing is carried on, and more important still will give an experience in material and activities common to all productive industry.

The three lines which best meet these conditions are wood, metal, and the electrical industries including the application of power. This report has, therefore, recommended that the shop work of the first year deal with carpentry, the second with patternmaking, the third with machine shop practice. The second year's service is given to the applications of power to industry. The fourth year is reserved for elective work of a more intensive character in some one of the above mentioned subjects. The outline for shop work just suggested is recommended in view of the present conditions. If the school were being started as a new venture modifications like the following would be strongly urged:

(a) Forging is only a small phase of the metal working business and is seldom encountered particularly in New England as a separately organized industry. Less time should probably be given to it as a subordinate and more or less incidental part of the machine shop training. The time, space, and money thus gained could be devoted to practical instruction in foundry work. It is fair to point out here that the forging now given in the schools is unusually well taught. The equipment is in general excellent. These facts, together with the large expense of making pronounced changes in this department, make it advisable to recommend the continuance of this course with a full recognition at the same time of the ultimate need of reorganizing the work in accordance with the above suggestions as soon as the resources of the school will permit.

(b) Instruction in the electrical industries including power should ultimately not be given merely as a part of the course in science which seems necessary at the present time, but should be placed as far as possible on the same practical basis as instruction in other shop work and be given an equal amount of time.

Following the practice of the High School of Commerce, provision should be made whereby the pupil may spend his summer vacations at some line of work in productive industry. For the satisfactory performance of this work credit should be given by the school.

11. *English.* The pupil need not be given college preparatory English nor should he be trained on the theory that he is to be primarily a debater, a public speaker, or a professional writer. He should study English from two points of view, (1) that of appreciation, (2) that of use.

The English of appreciation should aim to develop in the pupil a love of good reading. The instruction should take the

pupil where it finds him and endeavor to train him to appreciate good books that are within his ability to understand. It should give him a reading habit for such publications as:

Good elementary books on social economic and industrial questions.

Standard magazines.

Those things in past literature which appeal to him as an adolescent, together with the best writings of our own day, such as the following: Poe's Tales and Poems, Kipling's Tales and Poems, Stevenson's Tales, Franklin's Autobiography, Cooper's Mohicans, Portor's Captains of Industry, Scott's Quentin Durward, Ivanhoe, and other Border Tales, Kingsley's Westward Ho, Hyde's Speaker, Selections from Les Miserables, Dickens's Tales of Two Cities, Tennyson's Idylls, Wister's U. S. Grant, Merchant of Venice, Hawthorne's House of the Seven Gables, stories and novels of an historical character, biographies of statesmen, successful generals, captains of industry and business, and other men of affairs.

The English for use should prepare the pupil to employ his mother tongue effectively as a means of expression both as a citizen and prospective man of affairs on the one hand and as a worker and prospective executive in industry on the other. Here the habit and power of clear, concise, and forcible oral and written presentation of thought should be the aim. This requires instruction and practice in how to collect, organize, and present information in both oral and written form. It involves many such things as the reading and study of business and trade journals, trade union publications, books of reference of various kinds, the collecting and use of first hand knowledge gained by personal investigation and experience, the study of the best examples of modern day speech and writing as illustrated by such publications as the *World's Work*, the *Outlook*, the *Literary Digest*, the *Review of Reviews*, and by the public addresses and popular writings of President Wilson, of ex-President Eliot of Harvard, and other men prominent in public life. Carefully prepared class talks should be required from the pupils and class, interclass, and inter-scholastic debates as well as writing for the school paper should be encouraged. The present excellent instruction in English now being given in the school should be extended along these lines, a thing readily accomplished with the present teaching staff when the school ceases to fit for college.

Perhaps more important still is the need of business English. Every pupil should be brought into contact with the best business English as used by business men in magazines, correspondence, and talks and in such documents as the United States Consular Reports. He should have abundant practice in the repeated writings of all sorts of business composition, such as letters, specifications, reports on special subjects in industries, reports on local industries, advertisements, instruction sheets and notices, contracts and agreements, the spelling and use of technical terms employed in productive industry, catalogues, remittances, applications for positions, market reports, news letters to trade publications, exposition of manufacturing processes, and circular letters.

Among the subjects upon which written papers might be required from time to time are such as the following:

Standard methods of doing certain types of work.
Construction and operation of machines.
The history and use of tools.
Sources and uses of materials.
Reports on shop jobs and laboratory experiments.
The layout of shop work organization.
The routing of jobs.
Recent improvements in machine construction.
"Shop kinks."
"Tricks of the trade."
Problems of the engineer.
Marketing the output of the school.
How a central power station is operated.
Stock systems.
How to avoid shop accidents.
Reviews of articles in industrial publications.
Papers on general topics of interest.

APPENDIX C

SUGGESTIONS CONCERNING METHODS OF INSTRUCTION

In approaching a new subject for the first time, the shop should be made the point of departure wherever possible. How this can be done it is impossible to state in detail within the

limits of this report. An example of how industrial accidents as a topic of economics might be studied, for instance, will illustrate the method which in general should be used in the classroom. In taking up this subject for the first time, the teacher of economics might well ask the shop instructor to give a lecture on some of the causes of accidents in the shop, including instruction as to the danger points in machines and how to safeguard against them, followed by some consideration of the various devices for this purpose now on the market. This should be followed by visitation to outside plants and classroom study covering among others, such topics as these:

1. Typical accidents occurring in industrial plants.
2. State factory regulations concerning accidents.
3. Comparative importance of this subject before steam and invention brought the factory system.
4. History of accidents as a phase of industrial life during the past 100 years, beginning with the fellow servant doctrine and including the doctrines of assumed risk, employers' liability, workingmen's compensation, and old age pensions.

Similarly, the classroom instruction in practically all the subjects in the course of study, with the possible exception of certain instruction in citizenship, should, wherever possible, begin with the activities of the shops and lead out into the practical affairs of industry with which the boy on leaving the school will be concerned. This requires not only frequent and regular conference between shop and classroom instructors, but it also requires classroom teachers who have had some contact with industry.

APPENDIX D

SUGGESTIONS AS TO IMMEDIATE CHANGES IN THE SCHOOL

1. *Immediate changes in the course of study* as already suggested should be confined to the first year class and should be put into effect before the first of September of the current year. Previous to that time a committee from the faculty should carefully study the problem to determine what changes are possible and to make all needed preparation.

As a part of such preparation the guidance committee elsewhere recommended in this report should be organized before the close of the present school year to aid in the proper selection of pupils to be admitted in September. If this should not prove feasible a temporary committee should be appointed from the faculty for this purpose.

2. *Organization.* The present scheme of faculty organization in the school is the usual departmental organization found in most high schools, there being one head teacher for each general subject, such as history, English, mathematics, drawing, forging, and patternmaking, who is in a way responsible for the teaching of his special subject in all the years of the course. Every experience goes to show that this plan, unless accompanied by other and special groupings of teachers, tends to emphasize and isolate each special subject at the expense of other subjects and to prevent that close correlation between the various subjects of the course which is necessary to effective teaching even in the ordinary high school.

The scheme of training recommended by this report requires an intimate working connection between the shops and the instruction of the classrooms in practically every subject. It is absolutely necessary that the school develop some method of administering the course of study which will organize the members of the faculty in such ways as to make each subject of the largest possible advantage in the teaching of every other. Just what device or devices will be most effective in accomplishing this only the experience of the school itself can answer.

If these recommendations are to be carried out the entering class of 1914 must be smaller than heretofore. Whatever may be the actual number which might be admitted, the total of the school, particularly of the class of 1918, should not be permitted to be so large as to interfere with the efficiency of the instruction.

This report does not believe that even with the alterations here proposed on page 181 more than 1,200 pupils can be accommodated in the building with the course of training herein suggested. This probably means that not many more than 400 pupils should be admitted as freshmen in the coming September. The writer desires to go on record as saying that, with the present floor space available even with the changes herein

proposed, not more than 1000 pupils should be accommodated in the school.

Undoubtedly better results would be gained if the present average enrollment of classes be reduced from thirty-four to a maximum of twenty-four. This may mean an increase in the per capita cost of the school which may not be regarded as advisable at the present time. All experience would show that not more than twenty can be taught to the best advantage by the usual instructor. In any event the enrollment of any given class, beginning with the class of 1918, should not under any circumstances be greater than twenty-eight and the school authorities should begin at once to plan for a pronounced reduction in the size of classes to follow.

3. *Equipment.* No attempt will be made in this report to deal with the changes and additions in equipment or alterations in building which would be necessary to carry out the work of the second, third, and fourth years, as herein recommended. It must, of course, be understood that even the suggestions regarding the changes and additions to be made before the first of September, 1914, are not offered in any sense as absolute, but merely in a tentative way as affording a feasible working plan.

It is assumed that not more than 1200 pupils will be accommodated in the building. This probably means that, taking into consideration those returning in the second, third, and fourth years, not more than fifteen sections of freshmen will be enrolled, these sections to contain not more than twenty-eight pupils each. On the basis of those assumptions, it is believed that the following changes in the building and equipment are necessary to accommodate the class of 1918 taking the new course of study outlined on pages 30 to 32 in this report.

1. In order to make laboratories for elementary science, the large rooms (39–49–59) on the third, fourth, and fifth floors should be employed.
2. Remove some of the lathes from the turning shops.
3. Remove some of the benches from the wood-working shops.
4. Remove some of the tables from the drawing rooms.
5. Distribute some of these lathes, benches, and tables among the other shops, laboratories, and drawing rooms.
6. Furnish each woodworking shop with such machines and appliances as: two or three drawing tables and woodturning lathes, a circular saw, band saw, surface planer, and joiner. At

least one of the rooms should be provided with a mortising machine, straight moulder, boring machine, and a steam box for bending wood.

7. Equip each elementary science laboratory with the apparatus and facilities necessary to teach simple mechanics and the elementary properties of materials. There should be also some commercial apparatus illustrating the industrial application of the principles taught. Each laboratory should have several long tables, containing four to six sinks each. The benches from the woodworking rooms would make good individual tables.

4. *The cost of changes in equipment.*

The following is a tentative estimate of the probable cost of the changes in equipment for the first year's work recommended above.

No structural changes.	
Plumbing in large room A, to be used as machine shop, and in 39 and 40	$300.00
72 Science tables at $25	1,800.00
2 Lecture tables at $100	200.00
12 Wood-working machines with motors at an average of $300.	3,600.00
Apparatus for science laboratories	1,500.00
Labor of removing amphitheatre and desks from A 39, 49, and 59	300 00
Labor of installing machines	200..00
Shafting, pulleys, etc	200.00
	$8,100.00
Allow for errors in above	1,900.00
	$10,000.00

APPENDIX E

ANSWERS OF THE HEADMASTER TO THE QUESTIONAIRE WITHIN THE STUDY*

JULY 10, 1912.

I

Kind of a boy with which the Mechanic Arts High School deals? Since September, 1907, practically all boys who have applied for admission to the Mechanic Arts High School have been

* For full list of questions submitted in this study to the headmaster which are answered below, see Appendix L.

admitted. From 1902 to 1907 inclusive, a considerable number were refused on account of lack of accommodations, but for no other reason.) In September, 1908, all applicants were received, but about one-half of the first year class was provided for in the Rice School when it was transferred to the new building. (Applicants were received on the basis of general record for scholarship (not conduct) in the grammar school), but consideration was given in special cases to the mark for sloyd and arithmetic on the ground that boys notably weak in these subjects were less likely to succeed in the Mechanic Arts High School even if their general record was good, and, on the other hand, boys exceptionally strong in these subjects were likely to profit by the work of the school although weak in English, geography, or history.

After full discussion, the Committee on Manual Training of the School Board, unanimously decided that a selection on the basis of merit, as determined by the grammar school record, was the only defensible plan. At that time the pressure for admission was very strong and parents were naturally ready to criticise harshly any action of officials that could be attributed to personal bias or favoritism. It was recognized that the grammar school record was an imperfect test of fitness, but it was believed to be the best then available. As the decision touching from three to six hundred boys had to be made in a single day, it was obviously impossible to obtain and consider adequately the data suggested by 3 f, 1, 2, 3, 4, or to conduct interviews with parents. Moreover, the decision of any person, or persons, however wise and conscientious, based upon such data would have been sharply challenged in many cases. Equally open to attack would have been a selection by lot, for the parents of boys who had made good records in the grammar school believed that their sons had established a right to attend the school of their choice.

I have not recognized in my boys the characteristic differences between concrete and practical on the one hand and abstract and bookish on the other, implied by many of your questions. Every large group of applicants for admission to the Boston high schools contains a very small number who clearly belong to one or the other of these classes, but the great mass of boys who do tolerably well any form of shop work that

requires a fair measure of concentrated attention, foresight, judgment, and perseverance do equally well the usual academic subjects. The exceptionally capable boys excel to about the same degree in both the academic and mechanic department, and the very weak boys are equally unsuccessful in all branches. It is not improbable that there is a larger percentage of the concrete variety among graduates of the grammar schools who do not seek the high schools. I have no reason to think that there is a marked difference in type between the boys who enter the English High School and those who come to the Mechanic Arts High School, except that the latter have some taste for mechanical training or a conviction that such training will lead to agreeable and profitable employment. The boys who enter the Mechanic Arts High School doubtless incline somewhat to the concrete variety. This is natural and desirable. It is probable also that a smaller percentage of boys deemed exceptionally capable in the elementary school and a larger percentage of weak boys come to this school.

The boy best adapted to meet the demands of the Massachusetts Institute of Technology has been rather more likely to go to other schools, particularly the English High, than to the Mechanic Arts High School. Many boys of moderate ability have been sent to this school by parents who hoped that they would develop capacity and ambition for the training of a higher technical school. The combined activities of the classrooms, shops, and drawing rooms have stimulated them to greater exertion than they had been accustomed to make in the elementary school and the good teaching has enabled them to pass the examinations.

A. (A large percentage of the boys who have entered this school have come with the intention of ultimately pursuing an engineering career. In many cases their notion of engineering has been vague, but as clear as the notions of boys of thirteen or fourteen are likely to be touching their careers.) Many of the parents of these boys have been prepared to make heroic sacrifices to give them higher technical training if they showed that they were likely to profit by it. Even if these boys have failed to enter upon or complete the course in a technical college they have been vastly more satisfactorily trained in the direction of

their native aptitudes than they would have been in the English High School or in one of the district high schools. Their success, or failure, in a technical college has depended far more upon their native ability and ambition than upon their preliminary training, due to the need of earning money in time that should have been devoted to study. The fact that a considerable number of the very best men that have been graduated from the Institute of Technology and the Lawrence Scientific School in the last fifteen years have been prepared in the Mechanic Arts High School is strong evidence that the training which it gives is a satisfactory foundation for college work.

(I believe that one of the functions of the school should be to prepare boys for technical colleges. It was organized in 1892 as a high school. A fundamental principle of that organization was that it should be properly articulated with the schools below and above it. Movement from it to higher institutions of the same general type has always been recognized as fitting and logical.) This practice has had the approval of the subcommittee in charge of it, of all the supervisors or assistant superintendents assigned to it, and of each of the three superintendents who have held office since 1895. (That an intelligent community desires the continuance of this policy is conclusively shown by the record of enrollment. The rapid reduction in applications for admission and in the percentage of persistence in the various classes since 1909 has been very largely due to the announcement by the School Committee of an intention to make a radical change in the course of study.) Other causes, e. g., the change in the course in the elementary schools, the development of the High School of Commerce, and the organization of business courses in the general high schools, may have had some effect, but these causes would at most have merely checked the rapidity of the growth of the school. They would not have caused the alarming reduction in numbers shown by the statistics which I have submitted to you.

(If there are defects of organization or administration, they should be remedied without radical changes calculated to disturb the public mind and give the impression that the school has not accomplished its purpose. The records show clearly that it has done successfully the work for which it was organized. If new aims are desirable, in view of changed economic,

industrial, or social conditions, a course adapted to meet those ends should be developed in harmonious relationship with existing work.) If it proves to meet the public needs, it will gradually replace the old without injury to the reputation of the school or injustice to teachers who have a right to expect that the faithful discharge of the duties which they were expected to perform when they were appointed would lead to continuous employment under reasonably favorable conditions. Unless the causes that have been operating to make the school unpopular since 1909 can be removed, it will be necessary to dismiss many teachers in the near future. The announcement that the path of opportunity to higher education has been closed, in a school that has offered that opportunity for many years, tends strongly to give the public the impression that the school has been put on a lower plane. Many parents have called at my office to withdraw their sons reluctantly on account of the proposed change, but no patron of the school has ever expressed approval of it.

For some time the classes have been steadily growing weaker in aptitude for mechanical work, and this reduction in native mechanical capacity has been particularly noticeable for the last two years. If the school is to turn out men fitted for responsible positions in the industries on the business or directive side, its intake must not be confined to inferior boys.

13. If the changes proposed were made the reduction of the entering class at the outset would be about 50 per cent.

14. The typical boy wants a general education somewhat more practical than that given in the regular high schools including considerable shop work and drawing.

15. I have little evidence:

(a) That there would be such a field immediately.

(b) That the attendance would justify the existence of the school.

(c) That it would attract a different class of pupils.

16. I would favor a part-time or co-operative scheme if adequate funds were available, the demand became evident, and time could be found for it when the plant was not fully employed with its regular work.

17. No effort has been made in this direction.

18. Without a much more careful investigation than I have neeb able to make I cannot express an opinion touching the

part-time scheme most likely to be successful. Opening the shops in the summer and on Saturday appears to be most feasible. Valuable industrial instruction that does not require the use of the shop seems to be possible.

19. Mainly lack of funds and limitation of accommodation.

20. I believe that it is well worth while to do much more in this general direction. It is impossible to forecast the extent to which it will be successful.

20. I believe that it is well worth while to do much more in this general direction. It is impossible to forecast the extent to which it will be successful.

II

Vocational Direction and Placement*

1–3 inc. The curriculum of the Mechanic Arts High School includes many of the branches usually found in high schools, and they are taught in much the same way except that decidedly more emphasis is given to industrial history and to the practical applications of science and mathematics. The subjects peculiar to it are taught so as to give substantial knowledge of the elementary facts and applications of the fundamental mechanic arts. This curriculum has proved singularly attractive and inspiring to many boys, and has given very valuable general culture of a type distinctly different from that which results from the standard high school training. To the extent indicated in the foregoing it is a general high school.

It tends strongly, however, to arouse interest in occupations in which the special training of the mechanical departments can be utilized. It furnishes a good preparation for a large variety of occupations related to the industries in which knowledge of drawing and mechanical processes is an important element of success. To that extent it is vocational. It shortens the period of apprenticeship for those who decide to become mechanics, but it does not produce journeymen.

4. The best information that I have been able to obtain tends to show that a large percentage of the graduates have found employment appropriately related to the special training which they received. The number who remain in the industries as

*For list of questions answered below see Section B of Appendix L.

journeymen is small, probably not more than five to eight per cent. Many begin as apprentices, but soon rise to positions of some responsibility. Not far from 65 per cent become draftsmen, electricians, foremen, superintendents, and salesmen of mechanical products, or engage in some other occupation, more or less connected with the industries, for which their special training has given them a manifestly better preparation than the courses in other high schools. From ten to fifteen per cent follow the usual careers of high school pupils. Most of the others practice some form of engineering after completing the whole or a part of a course in a higher technical school.

Those who drop out generally accept whatever employment they can secure without much regard to their native aptitudes or training.

It is likely that nearly all of the boys who come to this school want the kind of education that it is adapted to give. My answers to your various questions indicate what that type is. Roughly, about five per cent are misfits.

For a series of years a little less than half of the members of the first year class have declared their intention of going to a technical college. Probably about half of that number have at the outset a fairly fixed intention of taking a higher course. Many desire training which leads to a technical college course on account of financial limitations.

None take the entrance board's examinations.

The percentage of boys who enter with a definite idea of the calling which they will follow is probably not large. I have no better basis for an opinion than the statistics recently obtained for you.

5. The choice of a high school is usually made in the light of such information as boys and their parents get from other boys who have attended high schools, or their parents, supplemented by the statements of the principals of the grammar schools. The percentage of parents who consult the principals is probably not very large and varies considerably in the different districts.

The course of study and the reports of the Committee on Manual Training, which I gave you, have been sent to the principals of the grammar schools. Since September, 1909, it has been impracticable for me to make any authoritative statement.

6–12 inc. Mr. Frederick W. Turner has been designated as vocational counselor for the school. He took the course in vocational guidance given in the Harvard Summer School last year and has attended the meetings of the vocational councils in Boston. He has read much upon the subject and gathered considerable valuable data. He is not relieved from regular duty on account of vocational work and can give little time to it. All of the teachers advise the boys more or less touching their future work. A few parents consult the headmaster concerning the admission of their sons, but neither he nor his teachers have an opportunity to influence much the choice of the great majority. Usually, the first notice received by teachers that a boy is about to withdraw from school is given when he returns his books. Many drop out without any notice and it is necessary to send for their text-books. If a conference with a boy who has announced his intention of leaving makes it seem likely that a letter will be of service, the headmaster writes to parents for an interview. About half of these interviews result in keeping the boy in school. In general, however, the decision to leave is made at home, and the school cannot change it. Many withdrawals are made on account of economic necessity. It is possible, however, that under favorable conditions the school might be of real service in many more cases.

I invite all members of each graduating class to write to me if they desire my aid in securing employment. Those letters are kept on file and assistance is given in many cases. Boys are occasionally placed for work during the summer.

I favor a systematic effort to deal effectively with the problem of vocational guidance. It is clearly desirable to discover as early as possible the native tendencies of boys, point out the advantages and disadvantages of occupations that seem attractive to them, and indicate the training which will help them most in the work they are inclined to follow. Efforts may well be made to place them in desirable positions, but this is less important than giving them clear notions about various occupations.

The work involves:

1. A study of the school records.
2. The preparation and distribution of information touching the school useful to graduates of grammar schools.

3. Conferences with many boys and their parents.
4. Visits to many homes.
5. Study of home economic conditions.
6. Conferences with employers both before and after boys are placed with them.
7. Efforts to discover causes of failure both in and out of school.
8. Efforts to guard against harmful amusements and unwise use of time out of school.
9. Ways of keeping in school boys who are inclined to leave without good reason.
10. Systematic records of information gained and work accomplished.

The above is, of course, only an imperfect outline. The work demands the entire time of a good man and a reasonable appropriation for expenses. I believe that adequate provision for this service is justifiable.

III

Study and Promotion*

1 and 2. Each teacher obtains his bi-monthly mark by combining the marks for daily recitations with those for numerous short tests; uniform tests for all divisions of the same grade are often prepared by the head of the department or by a teacher in conference with him. There is no fixed rule touching the relative weight to be given to tests and recitations, but the final mark is determined largely by the tests. Practice varies in different subjects. In the mathematical subjects the marks are based almost wholly upon tests. Equal weight is given to laboratory, shop, and academic subjects.

3. All of the work of the shop and much of the work in the laboratories is a test of manipulative or concrete ability. No set examinations are given to test such ability.

4. Roughly, about 25 per cent of those who leave do so because likely to fail. It is difficult to say whether a boy leaves to go to work because he is likely to fail or neglects his work and fails because he has decided to go to work.

5. The number of failures in 1911–12 were nearly in the ratio of the figures given below:

* For list of questions answered below see Section C of Appendix L.

First Year

Algebra, 5; English, 9; Science, 12; History, 5; Shop, 7; Drawing, 3.

Second Year

Algebra, 2; Geometry, 3; English, 4; French, 4; History, 2; Shop, 6; Drawing, 1.

Third Year

Geometry, 2; English, 3; French, 3; Physics, 3; Shop, 2; Drawing, 1.

6. Failures are mainly due to lack of ability, industry, and application. A few bright boys fail because they waste time with thoughtless or bad companions and neglect their home lessons. Probably some faithful plodders of fair ability fail because the pace is too rapid, but the number of such cases is very small.

7 and 8. There is much complaint about unsatisfactory home study. It is somewhat more marked in the first and second than in the third and fourth years.

9. Somewhat better results are obtained from the college group, but many boys in the non-college group do very good work.

10. The standards are higher for the college group.

11 and 12. Pupils who fail in two or more subjects are generally required to repeat the year's work. In doubtful cases pupils are promoted provisionally and given an opportunity to redeem themselves if possible. Those not promoted are not required to repeat shop work that has been done successfully, but more advanced work in the same or another shop is given.

13. Deficiencies are generally removed by passing examinations. Preparation for the examinations is made in the Summer High School, by study with private tutors, or by reviews without instruction. In some cases pupils are permitted to advance in most subjects and repeat those in which they are deficient. Each case is considered sympathetically and every boy is placed where it is believed that he will work to the best advantage.

14. Parents are notified of failures, conferences are held with them and with the boys, pressure of many kinds is brought to bear, and the boys are finally asked to withdraw when it is clear that the school can be of no further service to them without unreasonable demands upon the time of teachers.

IV

Character of Training*

1. In comparison with the regular high school the time given to academic subjects in the Mechanic Arts High School is about as follows: first year, two-thirds; second year, five-sixths; third year, a little more than two-thirds; fourth year, (1) shop group, a little less than two-thirds, (2) non-shop group, abou 20 per cent more.

2 and 3. French is required in the second and third years.

4 and 5. Three years of both shop work and drawing must be carried successfully.

6–11 inc. There is only one course, but while the subjects of study are the same, the work of the stronger division is distinctively more difficult than that of the weaker divisions. In general, the work of the stronger division is more abstract, that of the weaker divisions more concrete. There is, therefore, throughout the first three years a rough approximation to two different courses, and in the fourth year the shop and non-shop divisions have distinctly different work. Frequent readjustments of divisions are made on the basis of ability and success as shown by the marks. The data are gathered and tabulated by heads of departments and the final decisions are made by them in conference with the headmaster. The aim is to place every boy where he will work to the best advantage. Frequent conferences with parents and pupils are held. Abundant warning is given to pupils liable to be transferred to weaker divisions. They are kept in the stronger divisions until it is clear that different work will be more profitable for them.

12. There are no formal conferences of all headmasters touching the placing and transfer of pupils, but one headmaster occasionally confers with another about an individual pupil. Transfers are seldom sought by pupils who have not made a poor record in the school that they have attended. I have sometimes advised the transfer of boys exceptionally strong in academic subjects and very weak in shop work and drawing, but have generally been urged by parents to permit the boy to remain, on the ground that he needed the training of the shop to make him less one-sided.

13. Roughly, about ten per cent of those who enter each class complete the non-shop course of the fourth year with a record.

* For list of questions answered below see Section D of Appendix L.

which makes it likely that they can pass the examinations for admission to a technical college or entitles them to certificates for such colleges. Many equally able boys chose the shop course.

14. The school year 1911–12 was the first since 1900–01 when adequate shop accommodations were available for fourth year boys. For many years, shop work could be taken by fourth year boys only under very favorable conditions. A large number chose shop work in 1910–11, but they were employed much of the time upon the installation of equipment. The fourth year class of 1911–12 was divided as follows:

Number taking shop work and drawing.....	139
Number not taking shop work and drawing...	85

This division is what may fairly be expected with free choice under existing conditions. It is the theory of the school that along with shop work and drawing a course is given that will enable a large majority of the pupils to start in life advantageously, particularly on the business and directive side of industry, while giving to others, especially in the fourth year, more intensive academic work adapted to prepare them to pass the examinations for admission to technical colleges. A considerable number prefer to emphasize academic work in the last year although they do not expect to go to college.

17. At the end of the first year, but not later, transfers from the Mechanic Arts High School to other Boston high schools, or vice versa, may be made by those who have done good work. It very seldom happens that such boys desire to be transferred. Adjustments to the conditions and methods of a new school can never be made without some loss.

18. Answered under 13.

19. After discussion extending over six years, the question of the desirability and expediency of enlarging the Mechanic Arts High School, at a cost of $500,000, was referred to a committee consisting of Charles W. Eliot, president of Harvard University, Thomas I. Casson, S. J., president of Boston College, and Henry S. Pritchett, president of the Massachusetts Institute of Technology. On November 7, 1907, that committee unanimously recommended the erection of the large extension, the plans of which had been developed to meet the needs of a course of study substantially like that now in use.

When the school contains the largest number of pupils that can be provided for in the mechanical department, there will still be a sufficient number of classrooms for all the academic work unless the relative amount of that work is considerably increased. There is not now, and there is not likely to be in the future, any crowding of the school on account of academic work. It would be indefensible to transfer pupils doing purely academic work from this school, where there are adequate classrooms, to the English High School for which it is now necessary to hire accommodations. Moreover, pupils generally become attached to the school of their choice and loyal to it. Neither they nor their parents will consent without earnest protest to transfers that are not obviously necessary. After pupils have become acquainted with the teachers and methods of a high school, they cannot change to another without considerable loss in adjusting themselves to the new condition. There is no reason why all of the academic work now undertaken, or likely to prove desirable for those who wish to emphasize academic subjects, cannot be carried on in the best way without interfering in the slightest degree with the most satisfactory training of the more concrete boys who desire to emphasize shop work and the practical applications of their academic study. Every individual case will be studied more sympathetically and dealt with more wisely if it is only necessary to shift a boy from one department of this school to another than if he must be transferred to another school to give him the opportunities which he appears to need.

It may be that the functions of the school would be more clearly defined in the public mind and some advantages of administration secured by laying out the work in two distinct courses. These courses should be nearly parallel for two years, but would separate quite widely in the third and fourth years.

I prefer not to give more definite answers to the other questions until I have had an opportunity to discuss the whole problem with you.

V

Character of the Shop Work*

1. Time.

First year, wood-work with hand tools, 2 periods daily.
Second year, pattern-making, 2 periods daily, half year.

* For list of questions answered below see Section E of Appendix L.

Second year, forging, 2 periods daily, half year.
Third year, machine shop work, 2 periods alternate days.
Fourth year, machine shop work, 2 periods daily.

2. Qualifications of instructors.

See Circular of Information No. 48, 1911, p. 8, V.

A special assistant is employed in each shop or drawing room. These assistants are recent graduates of the school, chosen on the ground of their general fitness for the special work assigned to them. They serve on a temporary basis usually for not more than two years.

3. Covered in two.

4 and 5. The heads of departments are all men who have had prolonged trade experience before taking up school work and their scholarly instinct and ambition have combined to keep them well informed. Their numerous visits to factories and conferences with manufacturers touching machinery and equipment have given them definite information touching the progress of shop methods. Not only the heads of departments, but all other instructors are constant readers of trade journals and books relating to the various industries. Several of the younger instructors have taken courses in the Harvard Summer School. One of them spent a summer with Buff and Buff Manufacturing Co., makers of high grade surveying instruments. He spent another summer, under the direction of Mr. Turner, head of the department of pattern-making, securing information from various manufacturers for the Massachusetts Industrial Commission. Another instructor is spending the present summer working in the shops of the Blanchard Machine Co. Another is in an automobile shop in Beverly. Another spent a summer a year or two ago in a planing mill in Roxbury. Several of them have taken courses in the Lowell Institute School for Industrial Foremen. All of them have made themselves reasonably familiar with the industries of Boston and vicinity by frequent visits to factories.

With the exception of the instructors in wood-working, the younger instructors in shop work are associated as teachers of evening classes with other teachers who hold responsible positions in commercial shops.

6. Largest number of pupils in a shop class:

First year, 40; second year, 36; third year, 32; fourth year, 39.

7. Smallest number of a shop class:

First year, 18; second year, 22; third year, 26; fourth year, 31.

These small numbers apply to only a few divisions near the end of the school year.

8. The number of pupils per shop instructor depends upon so many conditions that I can make no general statement.

9–13 inc. In all subjects during the elementary stages the teaching is by lectures and demonstrations to group, but it is always supplemented by individual instruction. After a demonstration all pupils proceed upon the same work except those who are not prepared to go on with their classmates because of absences from previous lessons. Much individual work is done by rapid workers who complete regular jobs in advance of their classmates. They work either alone or in groups. At the outset, in any shop, special class work is advisable both on account of economy and efficiency in teaching. The demonstration to groups stimulates the teacher to do his best and relieves him from the constant repetition which exhausts both his strength and his interest in the subjects. A well conducted class exercise provides for discussion and questioning which react favorably upon both teacher and pupil. Emulation and initiative are important incentives especially with the younger boys. In the earlier stages in which class work can be carried on effectively the objection to the individual method is that it makes unnecessary demands upon the time and energy of teachers, but when boys are engaged upon fairly difficult projects, individual instruction is indispensable. The group method is preferred for all of the reasons stated in Question 11. In the later stages of the work in each department groups are selected for special work with the end in view of securing the advantages of co-operation and direction—one student acting as the leader or boss.

The cost of material for any form of purely individual instruction would be excessive.

All supplies and materials are purchased by the city. The pupils pay the cost of material for private, individual projects. They take home what they make unless the article is of use to the school. The appended list shows that many things are made for the school. No part of the output of the shops has been sold.

The original installation of the shop equipment was completed in 1895. All additional shafting and machinery have been installed by the instructors, assisted by pupils. This work of pupils has always taken the place of other shop exercises, and has been conducted in such a systematic way as to give valuable experience together with clear and definite ideas of practical methods of procedure. Student labor has never been used merely to get a given job done quickly and cheaply.

14. This question is intended to indicate an educational aim which has existed in manual training high schools for many years without being clearly recognized and formulated. It is not yet possible to give it an accurate and comprehensive definition. Not many boys enter the Mechanic Arts High School with this aim fairly definitely in mind, but its significance is measurably revealed as they go on with the course. The work of the school may be improved in this general direction by further development of the courses in industrial chemistry and physics, industrial history, the first year course in elementary applied science, and by increased emphasis upon the applications of mathematics together with more instruction in the shops relating to various phases of industry. To go further and devote much more time to shop work and drawing, put the shops on something like a productive basis, provide for much more individual instruction and for group work on fairly important projects, would increase the expense enormously and diminish correspondingly the number of pupils that could be accommodated. The equipment is well adapted to such work as has been carried on and will yield readily to considerable modification in details of method, but it is not suited to work approaching that of a trade school. The safe course is to seek for practicable improvements of existing methods rather than for radical changes of general policy. In most departments, changes in the character of the work and in methods of procedure have been made every year since the school was organized. In several departments the changes made during the past three years have been important. Funds are not available to sustain a much more expensive policy. The school has always done very much more than is generally realized to make boys "industry wise."

15 and 16. Visits to industrial establishments are made by members of the fourth year class under the direction of the

teachers of chemistry and of shop work. These visits are carefully planned and explanations are given in advance touching the points of interest to be observed. More of these visits would be profitable, but they require the time of instructors and involve expense for which no provision has been made. Occasional addresses by manufacturers, foremen, etc., are likely to be worth while. It is not probable, however, that they can be made a permanent part of the regular instruction. Practical men are not likely to be good lecturers and those who are can hardly be expected to give their time freely year after year.

17. (a) Boys generally work from drawings made by themselves, though the drawings are often pencil sketches carefully made, but not to exact scale.

(b) Most of the prints used in the shops, after the first year, are from original drawings and tracings made in the drawing department by pupils.

(c) The work is done mainly as follows:

First year, from sketches made in the shop.

Second year, from sketches made in the shop.

Third year, from blueprints of drawings made in the drawing room by the pupil doing the work or by other pupils. Some blackboard drawing by the instructor is used.

Fourth year, some blueprints of drawings made in the drawing room are used. Many sketches, especially of other than standard pieces, are made in the shops.

The shop instructor checks the drawings made in the shops.

(f) The shop projects are usually determined by the head of the department in consultation with his assistants, in accordance with general plans approved by the headmaster.

(g) The work of the shops is laid out and the character of the drawings for executing it is determined by the shop instructor. The first drawings are sometimes made by him. Models for use in the drawing room are occasionally made in the shops.

(h), (i), (j). The shops and drawing rooms are intimately related as indicated above. Each department has its own function, but the purposes of both are often served at the same time. It is desirable to emphasize the practical applications of drawing, but the exact relation which exists between the drawing rooms and the shops in a manufacturing establishment is not wholly practicable in a school. In the industries the work to be done is determined and planned in the drafting room, to

be executed in the shops, for the sole purpose of obtaining a product which can be sold. The purpose of the school is to co-ordinate shop work and drawing and give thorough instruction in both.

18. The aim of the work in each shop is (1) to give the pupil the power to handle intelligently the fundamental tools and materials of the trade (pattern-making, for example), and (2) to give him as much knowledge of the essential processes as practicable by making typical products (patterns) fairly well. Neither technique nor output should be strongly emphasized. Knowledge and power are the desirable ends.

19. Best explained in an interview.

20 and 21. See appended list.

22. Among the purposes of the shop work are all of those suggested by (a–f), inclusive.

VI

The Drawing*

The time given to drawing is as follows:

First year, lessons on alternate days, equivalent to 2½ periods per week.

Second year, lessons on alternate days, equivalent to 2½ periods per week.

Third year, lessons on alternate days, equivalent to 2½ periods per week.

Fourth year, lessons daily, 5 periods per week, in either (a) architectural design, (b) machine design, (c) industrial design.

In the first year, about three-fourths of the time is given to free-hand work, mainly technical sketching, the rest to instrumental working drawings of simple objects. This course is intended to co-ordinate and make more effective the drawing required in the shops and in the classes in elementary science.

The second year is devoted to orthographic projection—type forms, cutting planes, etc.—together with elementary machine drawing. Much of this work is preceded by free-hand sketches which take about one-fourth of the entire time.

The third year is devoted to orthographic projection, intersection of solids, and architectural and machine drawing. Many of the architectural and machine drawings are preceded by free-hand sketches. This free-hand work takes about one-fourth of the entire time.

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* For list of questions answered below see Section F of Appendix L.

In the fourth year a boy may give his entire time to one of the following:

(a) Architectural design.
(b) Machine design.
(c) Industrial design.

The work in (c) is mainly free-hand; in (a) and (b) about one-fourth of the time is given to free-hand sketching.

Number of drawings by each pupil:

First year, 50+.
Second year, 20–25.
Third year, 15–18.
Fourth year, 12–15.

The only available samples of drawings are mounted so that it is inconvenient to send them. I hope that it will be possible for you to examine them with me at the school. Nearly all of the drawings have been taken away by the boys who made them.

VII

Additional Questions

1–3 inc. Definite instruction is regularly given upon such topics as: sources, methods of production, varieties, and characteristics of iron, steel, and other materials used in machine construction; grinding wheels, files, belts, lubricants, measuring tools, standards of measure, transmission of power, art of cutting metals; origin, preparation, transportation, local purchasing points, and cost per thousand of many varieties of lumber; materials used in the shops, such as glue, brads, screws, shellac; name, size, standard makes, price, and local purchasing points of all the ordinary tools. Special attention is given to computing cost of stock, both from drawings and from direct measurements. This computation takes account of percentage of waste, value of lumber in the pile, cost of delivery, etc.

Some of these topics are treated by talks occupying the greater part of a lesson. Others are introduced in connection with lectures dealing with the shop processes which suggest them. No set time is assigned to such work. It is all done incidentally in connection with the demonstrations and discussions in the shops. The total amount of time given to it has not been great, but the interest aroused has been encouraging. Some of the information suggested above is emphasized in visits to manufacturing plants.

Commercial shop methods are always mentioned and explained in comparison with the simpler job-shop methods by which the pupil is usually first made acquainted with a process, and frequently the commercial method of procedure is actually used in the school shops. For example, a given process is taught by performing the operation upon a number of pieces in a lot; special fixtures are set up for handling the entire work of a group; simple jigs, forming tools, and other means of securing rapid production and interchangeability are used. Pupils often participate in planning and making the special tools required. In the machine shop tool-rooms, up-to-date reference books are kept for students' use, giving data concerning tools, screws, bolts, and a multitude of standard machine parts and shop supplies.

In all departments there is some form of shop system calculated to emphasize the need of co-operation, the checking and inspection of work, the cost of material, the value of time, and the general responsibility of each pupil for efficiency. These matters receive increased attention in the latter part of the shop and drawing courses, and become relatively more important as the time devoted to these subjects by a given pupil is increased.

An entire class in drawing is sometimes treated as a drafting room force.

Blanks are herewith submitted indicating the development of a simple shop system adapted to produce some of the results above mentioned.

We are inclined to increase the attention given to the above and to whatever is suggested by 1a, b, c, d, e.

The teaching is by instructors who have had practical experience in the industries.

VIII

Qualifications of Teachers

Mr. Eddy, head of the department of wood-working, was a journeyman carpenter, who became one of the pioneer teachers of manual training in the Boston grammar schools. He has done much high grade cabinet making and carving. I think that he gave you a fairly full account of his career.

Mr. Sweet, head of the department of machine shop practice, spent seven years as apprentice and journeyman machinist, three years as superintendent of the shops of the Cambridge

Street Railway, after which he was employed seven years as instructor in machine shop work in the Rindge Manual Training School, before coming to this school in 1896.

Mr. Raymond, head of the department of forging, spent one year as a stationary engineer, about three years working at general blacksmithing, three years as instructor of forging in the Massachusetts Institute of Technology, and three years as instructor in forging in the Chicago Manual Training School, before coming to this school in 1895.

Mr. Turner, head of the department of pattern-making, spent fourteen years with the Gamewell Fire Alarm Telegraph Company as apprentice, journeyman, department foreman, chief inspector, traveling salesman, and superintendent of the factory. With this company he had experience in a very wide range of mechanical work. He then had eight years' experience as a teacher of machine shop work in the Rindge Manual Training School, before coming to this school.

Mr. Knapp, head of the department of drawing, was graduated from this school in 1896, in the first class which was sent out. After spending one year in the Engineering School of Tufts College and one year in the Massachusetts Normal Art School, he returned to this school as a special assistant, and has worked his way up by steadily increasing efficiency. He has never worked in an industrial establishment, but has had valuable experience in practical architectural work, and in making drawings to be sent to the patent office. He made many of the illustrations for Professor Hoffman's Metallurgy. He has been a faithful student of industrial methods.

After graduating from the Rindge Manual Training School, Mr. Temple had nine years of successful experience in the drafting rooms of industrial establishments. He received a diploma in each of two courses in Lowell School for Industrial Foremen.

Mr. Perry was graduated from the Natick High School in 1901, and from the Massachusetts Normal Art School in 1905. He had successful experience in teaching and did considerable commercial illustrative work, before coming to this school.

Mr. Parsons was graduate from Cornell University, B. S. in architecture, 1896. He had fifteen years of experience as an architectural draftsman, and in private practice as an architect, before coming to this school. He had taught three years in the Central Evening Industrial School.

APPENDIX F

TABLE 1

TABLE SHOWING OCCUPATIONS OF GRADUATES OF THE MECHANICS ART HIGH SCHOOL

	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	*'10	Total
Total Reporting	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1316
Electrical work	..	1	..	1	2	1	..	1	..	1	..	2	2	1	12
Draftsmen and designers	..	..	..	3	2	2	2	1	2	5	8	5	4	3	37
Mechanics, general	..	1	..	..	..	..	..	1	..	..	3	1	1	1	8
Machinists	..	1	..	..	1	..	1	1	1	..	..	..	2	..	7
Superintendents, inspectors, foremen, etc. (mech. work)	..	3	1	1	1	..	2	7	5	..	..	1	1	2	25
Engineers, civil, mechanical, electrical, sanitary	1	1	2	5	2	3	3	4	3	4	1	..	..	..	28
Assistants to engineers	..	..	..	..	2	..	2	3	1	4	1	2	4	2	21
Assistants, technical colleges	..	..	..	1	1	..	..	..	..	..	1	..	..	..	3
Teachers, mech. branches	..	1	..	1	..	..	..	3	3	1	1	..	5	7	23
Salesmen, mechanical goods	1	..	..	1	..	2	2	2	3	1	..	3	..	..	15
Salesmen, general	1	..	..	..	..	1	2	..	..	3	3	..	3	..	14
Clerks, mechanical	2	..	..	2	..	..	3	..	..	1	3	5	1	2	18
Clerks, commercial	1	1	..	..	3	1	..	1	2	5	5	3	3	3	27
Business, mechanical	1	..	2	3	1	..	1	2	1	..	..	1	..	..	12
Business, general	..	..	..	1	..	2	..	1	..	..	..	..	..	..	4
Architects	1	..	1	..	1	..	..	..	1	..	1	2	..	..	7
Chemists	2	..	..	..	..	..	..	1	1	..	1	1	..	..	6
Farmers, florists, etc.	1	1	..	..	..	..	..	..	1	..	..	..	..	..	3
U. S. Service, forestry, geo. survey, reclamation, etc.	..	..	..	..	1	..	2	1	..	..	1	1	..	..	6
Dentists	..	..	..	..	..	1	..	..	1	..	..	..	..	..	2
Chauffeurs	..	..	..	..	..	..	..	..	1	..	..	1	..	..	2
Aviators	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1
Marine officers	1	..	..	..	..	1	..	..	..	1	..	..	..	..	3
Miscellaneous	..	..	..	1	1	..	1	..	1	..	..	..	..	..	4
Students															
Mass. Inst. Tech	..	..	..	..	..	..	..	..	..	3	2	2	4	4	15
Tufts	..	..	..	..	..	..	..	..	..	..	2	2	..	..	4
Harvard	..	..	..	..	..	..	..	..	..	..	1	1	1	..	3
Textile School	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Mass. Agricul. College	..	..	..	..	..	..	..	..	..	..	..	1	..	1	2
Worcester Technical	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Harvard Dental School	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Mass. Normal Art	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1

This exhibit, compiled in April, 1912, shows all of the responses to requests for information mailed to the last known address of every graduate on May 3, 1911. The total number of graduates was then 1,547.

*Class of 1909 is omitted because all of the members had previously received a third year diploma.

TABLE 2

EXHIBIT OF EMPLOYMENT OF GRADUATES OF THE MECHANIC ARTS HIGH SCHOOL

	1896	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	Total
Total Reporting	..	..	..	..	..	..	..	..	..	..	..	..	575
Students													
Mass. Inst. Tech.	2	3	1	3	6	7	6	17	11	18	10	12	96
Lawrence Sci.	..	..	..	1	1	..	..	1	1	3	2	..	9
Normal Art	1	..	..	..	2	..	..	1	3	..	1	..	8
Other institutions	4	1	3	6	1	6	3	6	15	12	15	11	83
Graduates													
Mass. Inst. Tech.	3	2	..	10	4	3	2	2	..	..	..	1	27
Lawrence Sci.	..	..	..	1	..	..	..	..	..	..	..	..	1
Electrical business	..	2	..	1	..	..	..	2	4	3	6	4	22
Draftsmen	2	2	..	5	6	6	2	5	6	11	13	11	69
Stair, pattern-makers, and other mechanics	3	1	1	2	..	..	1	4	3	6	6	3	30
Machinists	..	..	..	1	..	..	3	2	..	1	4	..	11
Clerks	3	..	1	2	2	5	2	7	9	9	13	12	65
Assistants, M. I. T.	..	..	..	1	1	1	..	1	..	..	..	..	4
Teachers (mech. branches)	..	1	..	2	1	..	..	1	2	..	..	..	7
Assistants to engineers	..	..	2	1	2	2	2	1	1	2	3	1	17
Civil and mech. engineers	..	..	1	5	3	2	2	2	1	..	..	1	17
Salesmen	3	..	..	3	2	4	4	1	3	2	..	1	22
Mill engineers	..	..	..	..	1	..	..	..	..	..	..	..	2
Dentists	1	..	..	1	..	..	1	..	..	1	..	..	4
Designers (reflectors, patterns)	..	..	..	..	..	..	2	..	..	..	..	..	2
Mech. superintendents, foremen and inspectors	3	1	3	2	1	2	6	2	2	..	..	..	22
Forestry	..	..	..	..	1	1	3	..	..	..	..	..	5
Florists and fruit growers	..	2	..	..	..	..	..	..	..	..	..	..	2
Sanitary research	..	..	..	..	1	1	..	..	..	..	..	..	2
Advertisers	..	..	..	..	..	1	..	..	..	..	..	..	1
Mining engineers	..	..	..	..	..	3	..	2	..	..	1	1	7
Lawyers	..	..	..	..	..	1	..	..	..	..	1	1	3
Insurance	..	..	..	..	..	2	..	..	..	..	1	1	4
Lumber	..	..	..	..	..	1	..	1	..	..	..	..	1
Contractors	..	..	..	..	..	1	..	1	..	..	..	..	2
U. S. Navy Cadet	..	..	..	..	..	1	..	..	..	..	1	..	2
Marine cadet	1	..	..	..		..	..	..	..	..	..	..	1
Graduates													1
Colo. and Yale	..	..	..	..	1	..	..	..	..	..	..	..	
Univ. of Maine	..	..	..	..	..	..	1	..	..	..	..	..	1
Ministry (student)	..	..	..	..	1	..	..	..	..	..	..	..	1
Publishers	..	..	..	1	1	..	..	..	..	..	..	..	2
Merchants	..	..	..	..	1	..	..	..	..	..	..	..	1
Chemists	1	..	..	..	..	..	..	..	..	..	..	..	1
Mosaic glass worker	..	..	..	1	..	..	..	..	..	..	..	..	1
Real estate	..	..	..	..	..	..	..	1	..	..	..	..	1
Dairy farm and milk	1	..	..	..	..	..	..	2	..	..	..	..	2
Banker and broker	..	..	..	..	..	..	..	1	..	..	1	..	2
Cotton and wool	..	1	..	..	..	..	..	..	..	..	..	..	1
Musician	..	..	..	..	..	..	..	..	..	..	1	..	1
Unemployed	..	..	..	..	1	2	1	1	1	2	1	1	11

This exhibit, compiled in September, 1908, shows all of the responses to requests for information mailed to the last known

address of every graduate on February 17, 1908. The total number of graduates was then 1,188.

APPENDIX G

TABLE GIVING COMPARISON OF OCCUPATIONS OF GRADUATES OF THE MECHANIC ARTS HIGH SCHOOL AND THE ENGLISH HIGH SCHOOL

	M. A. H. S.	E. H. S.
Students	28	72
Lawyers	..	32
Clergymen	..	10
Physicians	..	28
Dentists	2	5
Veterinary	..	1
Actors	..	5
Clerks	45	134
Salesmen and buyers	29	95
Bookkeepers	..	36
Merchants	..	78
Bankers and brokers	..	14
Manufacturers	..	18
Real estate and insurance	..	18
Professors, principals, and teachers	23	10
Architects and draftsmen	44	9
Artists and photographers	..	4
Musicians	..	4
Assessors, commissioners, and examiners, etc	6	3
Piano workers	..	4
Truckmen	..	7
Policemen	..	8
Letter carriers	..	10
Engineers, civil, sanitary, S. S., elec. mech., and min.	28	33
Collectors and credit men	..	4
Editors and journalists	..	6
Machinists and patternmakers	15	6
Contractors, carpenters, and roofers	..	10
Electric and telephone	12	10
Tinsmiths and plumbers	..	2
Superintendents and managers	25	29
Conductors and firemen	..	2
Printers, engravers, and proofreaders	..	14
Railroad agents	..	4
Druggists and chemists	6	18
Painters and decorators	..	7
Private secretaries and stenographers	..	11
Reporters	..	3
Publishers and advertisers	..	2
Hotel and liverymen	..	5
Watchmakers and opticians	..	3
Farmers and ranchmen	3	4
Statistician	..	1
Mining	..	2
Observer United States Weather Bureau	..	1
Captain S. S. and marine officers	3	1
Janitors and porters	..	3
Tailors	..	3

APPENDIX G (*Continued*)

	M. A. H. S.	E. H. S.
Chauffeurs	2	
Assistants to engineers	21	
Assistants in technical college	3	
Business, general	4	
Business, mechanical	12	
Aviator	1	
Miscellaneous	4	19
	316	808

Naturally all the information in the above tabulation was gathered by the faculty of each school through the answers to questions made by graduates at class reunion and dinners and necessarily represents a fragmentary study of what are probably the most loyal and successful students of the two schools.

If we disregard, on the one hand, the occupations requiring a general college education, such as students, lawyers, clergymen, physicians, professors, principals, and teachers of the liberal and cultural subjects, and, on the other hand, the occupations requiring a technical college education such as assistants in technical college, engineers of all kinds, architects, and professors, principals, and teachers of technical subjects, it does not appear that there is very much difference on the whole in the variety or character of the callings followed by the graduates.

APPENDIX H

SUGGESTIONS AS TO DEVICES IN GETTING HOLD OF PUPILS DESIRING TO BE TRAINED TO BE INDUSTRIAL CADETS

1. Co-operation of the authorities of the Mechanic Arts High School with the grammar schools and the other high schools of the city by means of frequent and regular conferences with the principals, teachers, and vocational counselors of the grammar schools and the headmasters and vocational counselors of the other high schools.

2. Conferences with prospective pupils and their parents, in order to determine the pupil's interests, aptitudes, and prospects, his motives in coming to the school, and his probable fitness to profit by the training it offers.

3. Complete records from the grammar school, giving not only the usual school data, but also full information concerning the pupil's health, aptitudes, interests, and motives as discovered in the grammar school through vocational guidance. The record cards should be carefully worked out and sent to the M. A. H. S. for use by the vocational counselor of the high school.

4. Records of information from employers for whom the prospective pupil may have worked, touching such matters as interests, reliability, industriousness, habits, etc.

5. Records of information from parents covering such matters as occupation of parent, health of pupil, outside interests and employment of pupil, reasons for employment, parent's reason for selecting the school, and length of time he intends the pupil shall attend.

6. Conferences with the headmasters or vocational counselors of other high schools, and with parents before transfers are made to or from the school.

7. Systematic plans of advertising the work and aim of the school among pupils, teachers, and vocational counselors of the grammar schools, and the general public, including, besides conferences, such means as lectures, circulars, and newspaper articles.

8. Visits organized intelligently to inspect the Mechanic Arts High School where the work is explained to grammar school pupils. Parents' visits also should be arranged.

9. Tie up this work of selection with a well-rounded pre-vocational scheme of selection which will afford pupils a chance to sample varied industrial activities in the upper grades of the elementary school before selecting a secondary school.

APPENDIX I

COMPARATIVE PER CAPITA COST OF MAINTENANCE OF VARIOUS BOSTON HIGH SCHOOLS AND VOCATIONAL SCHOOLS

EXHIBIT I

COST OF INSTRUCTION PER PUPIL

	Public Latin School	English High School	Mechanic Arts High School
1895–6	$ 78.29	$ 82.28	$ 125.05
1896–7	79.06	77.02	96.06
1898–9	88.81	83.49	75.90
1899–00	89.27	84.89	74.07
1900–1	100.87	93.93	79.45
1901–2	103.54	108.56	74.77
1902–3	97.80	94.89	73.27
1903–4	100.61	91.69	73.53

From 1895 to 1904 the per capita cost of instruction per pupil in the Public Latin School increased more than 29%, and in the English High School more than 11%; while at the same time the cost per pupil of the Mechanic Arts High School decreased more than 40%. The decrease at the latter was produced almost entirely by increasing the number of pupils taught by each teacher in the class and shop rooms. The table given below shows that since 1903–4 there has been a very marked decrease in the cost of instruction at the first two boys' schools named above and a very marked increase at the Mechanic Arts High School. At the latter school the increase has been due largely to the decrease in the total attendance of the school during the past three or four years.

The per capita cost in the Trade School for Girls for the year ending January 31, 1912, based on the average membership, was as follows:

FOR PERIOD OF TEN MONTHS

Exclusive of cost of administration, supervision, and general charges $114.45
Inclusive of cost of administration, supervision, and general charges 118.76

The per capita cost in the Mechanic Arts High School for the same period, based on average membership, exclusive of the cost of administration, supervision, and general charges, was $88.53.

EXHIBIT 2

COST PER CAPITA OF THE DIFFERENT BOSTON HIGH SCHOOLS FOR THE YEAR 1912

Normal	$170.24
Brighton	94.24
Latin	93.80
Mechanics	88.53
East Boston	79.19
Charlestown	78.85
South Boston	78.64
Commerce	77.98
West Roxbury	77.61
Girls' Latin	74.81
Practical Arts	74.69
English	74.51
Roxbury	71.62
Dorchester	67.09
Girls' High	52.53

APPENDIX J

ANNOUNCEMENT OF INTENTIONS CONCERNING COLLEGE MADE BY PUPILS OF MECHANICS ART HIGH SCHOOL, MARCH 28, 1912

Year	Total	Number going to College	Undecided	Number not going to College
First	513	181	78	254
Second	315	150	14	151
Third	233	110	16	107
Fourth	230	101	15	114

APPENDIX K

POSITIONS FOR WHICH GRADUATES OF THE MECHANIC ARTS SCHOOL OF BOSTON SHOULD BE PROPERLY FITTED

This report is indebted to Mr. Arthur Williston, director of Wentworth Institute, for all the material presented in this Appendix.

If the Mechanic Arts School of Boston is modified in its plans according to the recommendations which I have submitted so

as to make its central purpose efficiency in preparation for practical work of life rather than preparation for college, its graduates would be well fitted for the large and already rapidly increasing number of important positions in mechanical, electrical, and architectural fieldss.

The four year course, as I have recommended it, is not intended to educate engineers, investigators, or teachers of applied science as is the technical course of the college and universities, nor is it expected that this course will enable its graduates to serve the more important and far-reaching problems in modern engineering; nor is it, on the other hand, a trade course intended for those who wish to become merely artisans or mechanics—this course occupies a middle position between these two field.

The trained workers in mechanical, electrical, and architectural fields at the present time may be divided in a general way into three distinct classes. The first and highest comprises men of superior ability and attainment who ordinate or direct important operations requiring, as a rule, the services of many subordinates. In the second class we find the engineering experts, the designing and consulting engineers, and many others who bear the prime responsibility for the successful operation of industrial or engineering enterprises. The third and last class is composed of the skilled and unskilled laborers, the mechanics of various degrees of training and efficiency.

Between the highest and the lowest class, however, there is another field—the workers of which constitute an intermediate class and occupy positions secondary and subordinate to the members of the first class, but, nevertheless, of much importance. The field for this intermediate class of workers has been widening very rapidly the last decade or two, especially during the last decade. In a general way the workers in it are the assistants to the engineers, the supervisors of skilled labor or the specialists forming one kind or another of operations that require some special knowledge or training in excess of that ordinarily possessed by the skilled mechanic. The graduates of the Mechanic Arts School of Boston should be competent to fill positions of this kind.

I can perhaps further indicate the type of positions that I have reference to by giving a list of typical positions in this class in mechanical, electrical, and architectural lines of work.

MECHANICAL POSITIONS FOR WHICH GRADUATES OF THE MECHANIC ARTS SCHOOL SHOULD BE FITTED

No. 1. In factories and manufacturing plants—
Inspectors
Detail designers
Draftsmen
Erection foremen
Engineers' assistants
Cost accountants
Production clerks and foremen
Piece work supervisors and foremen
Master mechanics
Department superintendents
Testers of special apparatus
Builders and testers of experimental work
Stock clerks
Production clerks for various departments
Investigators of efficiency of different methods of construction
Etc., etc., etc.

The above list is far from complete as there is not a large modern factory but what has in its organization the engineer and the skilled mechanics, and a very large number of positions of which the above are typical.

No. 2. For power plants and office buildings—
Assistant engineers
Stationary engineers
Superintendents in charge of heating systems and mechanical equipments.

No. 3. Motive power department in steam and electric railroad—

A great variety of positions similar to those indicated in group No. 1

No. 4. For factory and steam boiler insurance companies—
Inspectors
Draftsmen
Etc., etc.

No. 5. For sales department of factory and machine houses—

Clerks
Salesmen

Assistant engineers, etc., etc., who are competent to describe intelligently mechanical advantages and advise customers of the proper size and kind of machinery to purchase for their particular work and how to install it so as to obtain its proper efficiency.

ELECTRICAL POSITIONS FOR WHICH GRADUATES OF THE MECHANIC ARTS SCHOOL SHOULD BE FITTED

No. 1. Electrical manufacturing—

(a) Dynamos, motors, and general power apparatus—
- Draftsmen and detail designers
- Sub-foremen in shops
- Testers of apparatus in process of and after construction
- Foremen of erection in power plant
- Switchboard and power plant wiremen
- Engineers' assistants

(b) Telephones, telephone switchboards, and cables—
- Switchboard wiremen
- Switchboard testers and inspectors
- Cable testers
- Draftsmen

(c) Electrical instruments and apparatus—
- Inspectors
- Draftsmen
- Calibrators

No. 2. Power and lighting (operating companies)—
- Meter testers
- Switchboard and sub-station attendants
- Line foremen
- Sub-foremen on repairs or alterations
- Draftsmen
- Assistant stationary engineers

No. 3. Telephony (operating companies)—
- Troublemen
- Assistant wire chiefs
- Inspectors
- Engineers' assistants
- Sub-foremen in charge of construction or installation of switchboards, cables, etc.
- Assistant managers in traffic department

No. 4. Railroad work

(a) Steam railroad switch and signal department—
- Inspectors

Sub-foremen in charge of maintenance or new installations

(b) Electric railroads—
Power plant attendants
Sub-foremen of electrical maintenance, repairs, and alterations

No. 5. Marine service (merchant and naval)—
Draftsmen in equipment department
Assistants in testing department
Inspectors of electrical eqiupment
Assistant electricians and wiremen

Architectural Positions for which Graduates of the chanic Arts School Should Be Fitted

No. 1. In architects' offices—
Draftsmen
Detail designers and estimators

No. 2. Building operations—
Inspectors
Clerks of the works
Superintendents of construction

No. 3. In contractors' offices—
Draftsmen
Estimators
Inspectors
Etc., etc., etc.

No. 4. In planing mills, furniture, and other woodworking factories—
Draftsmen
Detail designers
Inspectors and foremen

The above list would give in a definite way the type of positions that I have in mind. These positions have not been chosen at random, but are taken from the list of positions which the graduates of our two year course in similar lines at Pratt Institute are holding.

If Pratt Institute can prepare young men in two years to hold successfully such positions as I have indicated, certainly the Mechanic Arts School of Boston should be able to do the same in four years. On the other hand, the Mechanic Arts School should maintain the full four year course in order that the

graduates may have the proper maturity. Pratt Institute students are required to be at least seventeen years of age at the time of entrance—the two years' difference in age requirements should be made up by the added length of course in the Mechanic Arts School.

It is not to be supposed that the graduates will be fitted to hold all of the positions indicated immediately upon graduation, nor that they will remain always in any one group of positions. Tendency will be for them to enter in the more subordinate positions, and as they gain experience, be promoted into the more responsible positions.

The following table giving the record of 218 graduates from a two year mechanical course at Pratt Institute may be of interest in this connection in showing the type of positions held by recent graduates who have had five years or less experience in practical work, and corresponding positions held by graduates who have had from five to ten or twelve years' experience.

TYPES OF POSITIONS HELD BY GRADUATES OF TWO YEAR MECHANICAL COURSE AT PRATT INSTITUTE

	Classes of 1903 and later	Classes of 1902 and earlier
General managers, assistant managers, superintendents, or foremen in charge of important departments of manufacturing plants	11	30
Proprietors of small manufacturing plants	3	1
Chief engineers	3	6
Chief inspectors or assistant chiefs	..	2
Chief draftsmen or assistant chiefs	14	15
Designers	17	9
Inspectors	9	3
Draftsmen	27	7
Machinists and apprentices	15	1
Testing positions	11	..
Teachers	2	3
Students in other schools	12	..
Outside of manufacturing and engineering work	9	8
	133	85
Grand total		218

Of those who completed their course five or more years ago, 63 per cent now hold responsible positions, and 10 per cent have left engineering work.

APPENDIX L

QUESTIONS SUMITTED TO THE HEADMASTER OF THE MECHANIC ARTS HIGH SCHOOL AND ANSWERED BY HIM IN APPENDIX E

I

Kind of Boy with which the Mechanic Arts High School Deals

1. Have you for the past few years accepted all the boys who apply as graduates from the Boston Grammar School?
2. If you have not accepted all of them, what is the reason?
   a. Do you lack accommodations for them?
   b. Are some of them unsuited for the work?
   c. Other reasons.
3. If you did not accept all of them, on what basis did you select your pupils?
   a. Did you reject some because you consider them physically unable to do the work?
   b. If so, on what specific test or tests did you base your opinion?
   c. Did you reject some because you considered them mentally unable to do the work?
   d. On what specific facts did you base your opinion, among which are:
      (1) Grammar School record in Arithmetic, English, Grammar, Nature Study, Geography, and Manual Training.
      (2) Apparent general intelligence, and if so, what are the tests for this?
   e. Did you reject some because of apparent financial inability to complete the course?
   f. If so, what information did you secure as a basis of your judgment and how did you secure it?
      (1) Did you find occupation of parent?
      (2) Did you get the wage of parent?
      (3) Did you find the home conditions, which might include number in family, income, both parents alive, son of widow, step-child?
      (4) Did you prefer the boy who was neat, well-dressed, polite, and gentlemanly in manner?
   g. Did you take into consideration the deportment or conduct record of the applicant in the Grammar School?

h. Do you prefer a boy who comes from a mechanical or from a scholastic environment?

i. Do you prefer a boy who has been in the habit of doing concrete things or the boy who has been in the habit of dealing largely with abstract things?

j. Do you prefer the boy who has shown a tendency toward practical work or academic work? What is the test or tests you use for this purpose?

k. To what extent has the wish of the applicant to follow a given occupation determined the selection?

l. If selection has been based upon applicant's prospective occupation, which occupations have been given the preference?

4. To what extent has the selection been based upon interviews with parents?

5. What use is made of records of Grammar School in selecting pupils?

   a. Why was this method of selection used?

   b. Why not draw names of applicants from a hat or accept them in the order of their registration until capacity of school has been reached?

   c. To what subjects in the Grammar School records would you attach importance in choosing a pupil?

   d. Is this importance attached because it is felt that special aptitude in these subjects is desirable for success in the M. A. H. S.?

6. Define the kind of a boy whom you regard as best fitted for the M. A. H. S. in terms of the following:

   a. Kind of ability.

   b. Aim or purpose in attending High School.

   c. Interest.

7. From your experience and observation do you believe that on the whole, under the system of free choice afforded in Boston, a different type of boy attends your school from the one who attends such a general high school as the English High?

8. If so, what in general are the characteristics of the two types of boys and what is the difference between them?

9. What type or kind of boy does such a technical school as the M. I. T. want, as shown by their entrance examinations?

   a. Is it the boy who has large capacity to deal with abstractions on paper?

   b. Is it the boy with the large capacity in the abstractions, of mathematics and science?

c. Is it the boy who likes to work with his hands?
d. Is it the boy having skill in mechanical processes?
e. Is it the boy who has had considerable practical experience in one way or another with industry?
f. Is it the boy who likes to work with books?

10. Do you believe that under the method used in Boston, the boy best calculated to meet the demands of such schools as the M. I. T. attends the M. A. H. S. rather than some other Boston high school?
11. If so, how do you account for the fact that the authorities of the M. I. T. and of Tufts Engineering School report that the records of the pupils of such manual training and technical high schools as the M. A. H. S., and the Rindge Manual Training School, are on the average much inferior to those of the pupils who come from regular high schools in Boston and elsewhere?
12. Do you believe that the course of study of the M. A. H. S. should continue to serve as a preparation for the technical college so that at the end of the four years' course the pupil could meet its entrance examination? If so, why?
13. If changes were made in the work of the school so that it could no longer serve as a preparatory school for college, what would be the effect upon the attendance of the school? What per cent of the kind of pupils now attending would, in your opinion, cease to apply for admission to the first year's work?
14. Are you of the opinion that the typical boy now attending the school wants the same kind of a general education as that given in other Boston high schools with some manual training in addition?
15. If the school should set up as its aim that of being a *finishing* school, fitting boys "to become industry wise" in order "that they may enter advantageously as non-commissioned officers into industry on its business and directive side," do you believe:
    a. That there would be a field for its service sufficient to justify the work of the school? Why?
    b. That there would be an attendance sufficient to justify the existence of the school? Why?
    c. That the school would attract pupils of any kind who do not at the present time attend it? Why?
16. Would you favor the establishment of a part-time or co-operative scheme for the after-training by the school of boys who had gone to work?

17. Has any effort as yet been made by the school to do this?
18. What kind of a part-time scheme would you favor, if any?
    a. Would you favor taking boys who had gone to work immediately after graduating from the grammar school?
    b. Would you favor placing boys after one year in the M. A. H. S. who leave to go to work, and bringing them back for after-training for a part of the time by the school?
    c. Would you favor doing this with boys after two years in the school?
    d. Would you favor doing this with boys after three years in the school?
    e. Would you favor opening the shops of the school during the summer for the benefit of boys who could be spared during the summer under a part time scheme?
    f. Would you favor opening the shops on Saturday to part-time pupils who could be secured by a co-operative arrangement?
    g. Would you favor any or all of the following allotments of the boys' time to the school:
        (1) Alternate weeks.....
        (2) Alternate days.....
        (3) One day per week.....
        (4) One-half day per week.....
        (5) One-half day per day.....
19. What are the difficulties or limitations to be met in carrying on such part-time or co-operative training?
20. To what extent do you believe a system of vocational direction and placing by the school of pupils before and after graduation in places of the kind for which the school was preparing them would attract and hold the boys who were seeking such preparation for such places?

II

Vocational Direction and Placement

1. Do you regard the M. A. H. S. as a general or a vocational school?
2. If it is a general high school, how does its work differ from that of the usual general high school?
    a. In aim .....
    b. In kind of boy dealt with .....

c. In kind of training given.....

3. If it is a vocational school, for what vocations or trades or occupations does it fit?
4. To what extent do the vocations for which the school fits determine the choice of the school by the boy?
   a. Roughly, what per cent of the pupils enter the vocations for which the school fits?
      (1) Of those who enter .....
      (2) Of those who graduate .....
   b. Roughly, what per cent of the boys who enter the school want a general education with some manual training in addition? .....
   c. Roughly what per cent of the boys want the kind of a general education which will enable them to attend college at its close, if they so desire at that time? .....
   d. Roughly, what per cent of the boys enter the school with the fixed intention of attending college?.....
   e. Roughly, how many boys try the college entrance board's examinations? .....
   f. Roughly, what per cent of these fail to pass these examinations? .....
   g. What per cent of the pupils, in your opinion, enter the school with any definite idea or choice of what calling they expect to follow? .....
   h. What per cent of the pupils, in your opinion, choose the school because it fits for the callings which they want to follow? .....
5. How is the choice of the school made by the pupil?
   a. Is it usually made without any consultation with school authorities? .....
   b. Is it usually made with the aid of the grammar school master or teacher? .....
      (1) What explanation or description of the work of the M. A. H. S., if any, is supplied to the grammar school principal for this purpose? .... If any printed or typewritten matter is supplied, kindly file a copy of it.
      (2) Is there any individual conference between the grammar school authorities and:
         (a.) The boy .....
         (b.) The parent .....
      (3) What facts do the grammar school authorities take into consideration before advising the boy to attend the M. A. H. S.?

c. Is it usually made with the aid of the principal and teachers of the M. A. H. S.? .....

(1) If not, when is it so made? .....

(2) When so made, is there conference with the parent? .....

(3) What facts do you take into consideration before advising the boy to attend the M. A. H. S.? .....

(4) In past years, when it was necessary to select from an excessive number of applications, was the selection based upon the vocational aim of the pupil or upon his grammar school record? .....

6. Are any members of the M. A. H. S. specially responsible for vocational direction and placing of the boys from the school? .....

7. Is this person, or persons, relieved from regular school duties to any extent in order that they may do this work? .....

8. How much time are they able to give to it? .....

9. What are the duties of these vocational assistants or directors?

a. Do they deal with the boy while he is making his choice of a high school?

b. Is it customary for boys who are about to withdraw from the school to give notice some time in advance of the fact that they expect to quit?

c. Is conference held with these boys as to the cause of their withdrawal from the school and as to the kind of work which they should follow after leaving school?

d. Is any effort made to place these boys who are about to quit school for work to which they are suited?

e. Is their conference, at the close of each school year, with the boys who have announced their intention of not returning for the following year, with a view to aiding them to make the right choice of work?

f. Is conference held with the members of the outgoing class before graduation with regard to:

(1) The choice of a college they should make .....

(2) The choice of an occupation which they should enter .....

g. To what extent does the school make an effort to place boys for work during the summer?

(1) Does it carry a register of boys seeking work? .....

(2) Does it carry a register of business men desiring boys? .....

(3) Does it make any active effort to find positions for boys, in addition to this? .....

h. To what extent does the school place boys in positions after graduation?

(1) Do pupils, upon graduation, register for positions? .....

(2) Is a register carried of business men desiring graduates of the school? .....

(3) Does the school make an effort to secure the co-operation of business men and manufacturers in placing students in positions? .....

10. Do you believe that the school ought to deal more extensively with this matter of directing and placing pupils? .....
11. If so, what would you recommend in addition to what is now being done?
12. In order to carry out the suggestion which you have made, do you believe it will be necessary for the school to employ in its faculty one teacher who gave a large part or all of his time to this task?
13. Are the different years of the course of the school arranged with the idea that each is a preparation for the year which follows, or are they arranged with the idea that the pupil, upon completing each, could, if he left school, carry out something that would prove of definite value to him in the vocation for which he seeks preparation or upon which he is likely to enter?
14. Do you believe that, by the same course of study, a pupil can be equally well fitted either to meet the requirements of the technical college or to go out into such vocations as are usually followed by the boys who leave the M. A. H. S.?

III

Study and Promotion

1. On what basis do you promote the boy?
   a. Do you give equal weight to all examination marks in all subjects? To classroom marks in all subjects?
   b. If not, do you rate marks in shop work as being equal to marks in non-shop work?
   c. Do you promote on examination marks alone?
   d. Do you promote on averages of classroom marks alone?

e. Do you promote on both?

f. If so, what relative weight do you give to class marks and examination marks?

2. Assuming that the term mark is made up on basis of examination marks and class marks in each subject, what relative weights are given to examination mark and class mark for each subject and as between subjects?

When an instructor in your school makes up the term mark on his subject, is there any uniform rule as to the relative value of the examination mark and the classroom average which is followed throughout the school?

If so, what is it?

If the school promotes on the average of term marks obtained in various subjects, how is the promotion mark obtained?

a. Do you give equal weight to laboratory, shop, and academic subjects?

b. If not, what values do you give and what are your reasons?

3. When examinations are given in laboratory and shop subjects, do they include tests of manipulative or ability?

4. What per cent of the pupils dropping out of your school do so because they have failed or about to fail to secure a passing mark?

5. What is the subject or subjects in which they usually fail?

1st year ..... 3d year .....

2d year ..... 4th year .....

College entrance examination .....

6. What are the causes of the failures?

a. Was it due to unsatisfactory teaching? .....

b. Was it due to unsatisfactory teaching conditions? .....

c. Was it due to inability to do the work? .....

d. Was it due to lack of application? .....

e. Was it due to insufficient time allotment? .....

f. Other causes? .....

7. Do your instructors complain about unsatisfactory home study? .....

8. Are these complaints more marked in the first, second, third, or fourth year classes? (Please mark as 1, 2, 3, 4, in designating degree, the years in which complaints were more marked.)

9. In your fourth year do you get more home study and better marks out of the college or non-college group? .....

10. Are your standards the same for both? .....
11. Do you promote by subject or by years? .....
12. Are pupils required to repeat the year's work?
    a. If they fail in one subject? .....
    b. If they fail in two subjects? .....
    c. If they fail in three subjects? .....
    d. Are pupils required to repeat unsatisfactory shop work? .....
13. How are delinquencies in the work of the school removed?
    a. Through repetition of work? .....
    b. Through additional coaching by teachers? .....
    c. Through summer study? ..... If so where? .....
    d. Through examinations .....
14. What procedure is followed when pupils fail?
    a. Are parents notified? .....
    b. Is there conference with the pupil? ..... With the parent? .....
    c. When are pupils requested to withdraw upon failure? .....

IV

Character of Training

1. How does the amount of time given in classes other than shop work and drawing compare with that given by such a general high school as the English High in:
   1st year ..... 3d year .....
   2d year ..... 4th year .....
2. In order to graduate from the M. A. H. S. is it necessary for a pupil to carry a foreign language successfully? ..... In what years? .....
3. If not, what other subject or subjects are accepted as a substitute or equivalent? .....
4. In order to graduate, is it necessary for a pupil to carry shop work successfully? .....
5. If not, what other subject or subjects are accepted as a substitute or equivalent? .....
6. How many different courses such as general course, college preparatory course, technical institute course, industrial course, etc., are offered by the school? .....
7. What is the purpose or end of each of these courses described in terms of:
   a. What kind of boy the course is for? .....

b. What kind of occupation or calling in general he expects to follow. .....
c. What the course is expected to do for him. .....
d. How it does it? .....

8. What is the difference between these courses?
   a. In aim .....
   b. In method .....
   c. In content .....
   d. In type of pupil .....
   e. In amount of time devoted to subjects taught .....
9. How are the pupils assigned to these different courses?
   a. Is assignment based on choice of pupil? .....
   b. Is this the result of consultation with:
      (1) Pupil .....
      (2) Parent or guardian .....
   c. Is assignment made by school on basis of pupil's choice of an occupation or calling? .....
   d. Is it made on basis of pupil's comparative interest in book work or shop work? .....
   e. Is it made on basis of the pupil's comparative aptitude in dealing with book work and such shop work? .....
   f. Is it made on basis of any test of any kind such as a temporary assignment to the work of a course? .....
10. If it becomes clear that, for any reason, a pupil is not fitted for the course which he is taking, is there any arrangement or practice whereby:
    a. He is shifted or assigned to another course .....
    b. To another high school .....
11. Is this shifting or new assignment the result of:
    a. Conference with pupil .....
    b. Conference with parent .....
    c. Conference with headmaster or other official of another school .....
12. To what extent is there at the present time conference or consultation between the headmasters of the Boston high schools, the assistant superintendents, or both, with regard to:
    a. Entrance requirements of different high schools .....
    b. Distribution of pupils among these high schools based on such considerations as:
       (1) Interest of pupil .....
       (2) Probable future occupation or calling .....

(3) Special aptitude or ability of pupil .....

c. Interchange of pupils between schools .....

d. Field of service to be met by each high school, general or special .....

e. Differences in aim and kind of training? .....

13. While the direct aim of the M. A. H. S. is not to fit for college, is the pupil who has taken the work of the school able to meet college entrance requirements? .....
About what per cent are able to do this? .....

14. Is the theory of the school in general that, along with shop work and drawing, a general course of training is being given which will enable the pupil upon graduation either to go to college or start advantageously in life, particularly on the business and directive side of industry?

15. Which of the following is the belief or theory of the school, so far as the aim of the pupil is concerned:

a. That he desires a general education with some manual training in addition? .....

b. That he desires to be fitted for a technical or other college? .....

c. That he desires a general education with the possibility of electing a college course at its close? .....

d. That he desires to be fitted for entrance as a wage earner in such trades or occupations as machinist, carpenter, electrician, patternmaker, etc.? .....

e. That he desires to be fitted for entrance into industry as a "non-commissioned officer on its business or directive side"? .....

16. What are the differences in the kind of training other than shop work and drawing, between the M. A. H. S. and other general high schools such as the English High?

a. Do you use the same kind of text-books? .....

b. If not, what in general is the difference between them?

.....

c. Please give one or two illustrations of this difference.

e. If not, what in general is the difference in method? .....

.....

f. Please give one or two illustrations of this difference.

.....

17. Is it possible for a boy to shift at the close of a given year from the M. A. H. S. to another Boston high school, or vice versa, without being "set back" in or greatly handicaped in his academic work:

1st year ..... 2d year ..... 3d year .....

18. What is the number and the per cent of your 4th year class for the past two years who elected not to take:
    a. Shop work .....
    b. Shop work and drawing .....
19. In view of the crowded condition of your school and the further fact that such pupils were confining themselves practically entirely to academic work, would it be advisable to transfer them to other Boston high schools for the last year's work? ..... Why? .....
20. Assuming that the aim of the school is or may become that of a finishing school fitting boys "to be industry wise, so that they may enter advantageously as non-commissioned officers of industry on its business and directive side," is it your opinion that the training now given by the school is best calculated on the whole to accomplish this stated aim?
21. What is the reason for your answer?
22. If not, what changes in the course of study and the method of teaching would you make, in order to accomplish it better?
23. In order to accomplish these changes, what differences or alterations would you make in the administrative side of the work?
    a. Would it be necessary to reduce the number in the incoming first year or Freshman group? .....
    b. Would it be necessary to reduce the size of the classes for instruction purposes:
        (1) In the shop? .....
        (2) In the classroom? .....
    c. Would it be necessary to purchase additional equipment? .....
    d. Assuming that such changes as you suggest would be introduced only with incoming classes, what would be your estimate of the additional cost by years of such equipment?
        (1) 1912–13 ..... 1915–16 .....
        (2) 1913–14 ..... 1916–17 .....
    e. Would a larger teaching force be required:
        (1) If size of classes were reduced and registration be undiminished? .....
        (2) If size of classes and total registration were reduced? .....
    f. Would changes in your teaching force be necessary? ..... If so, what? .....

g. Would you have to change the character of your teaching? .....If so, how? .....

h. Would the per capita cost of operating the school be increased? .....

(1) Why? .....

(2) To what figure (estimated)? .....

24. Would you favor grouping the pupils for instruction into two groups, one fitting for college and one fitting for work as non-commissioned officers of industry, or would you favor continuing the present arrangement? .....

25. If you favored grouping as suggested in question No. 24, would you have the same or a different course of study for each group? .....

26. If different courses of study, please state the important differences between them? .....

27. Would you use the same or different methods of instruction? .....

28. If different methods of instruction, what would be the chief difference in the methods used in training the college and the non-college group? .....

V

Character of the Shop Work

1. How much time is given to shop work?
   1st year ..... 3d year .....
   2nd year ..... 4th year .....
2. What are the minimum requirements of the school on selecting instructors for shop work as to
   a. Academic training
   b. Technical knowledge
   c. Trade experience
3. If there be shop assistants to the instructors what are the requirements for them as to
   a. Academic training
   b. Technical knowledge
   c. Trade experience
4. To what extent do your shop instructors keep up with present methods?
5. How many have more than this minimum requirement and how much more?
   a. Shop instructors

b. Shop assistants

6. What is the largest number of pupils in a shop class?
   1st year ..... 3d year .....
   2d year ..... 4th year.....
7. What is the smallest number of pupils in a shop class:
   1st year ..... 3d year .....
   2d year ..... 4th year .....
8. What is the maximum number of pupils per shop instructor that in your opinion a school should have?
9. Are pupils taught their shop work by the group or by the individual method?
10. Are new exercises preceded by lecture and demonstration or are they given to pupils individually with individual instruction? Do all pupils in a given class work on the same exercise at the same time?

    Which of these two do you regard as being most effective?
11. Is an effort made to do this or to avoid it?

    If you use the group method of teaching, please give the reason:

    a. Because the method is best as a means of teaching .....
    b. Because the class is too large to be handled otherwise .....
    c. Because the equipment is best adapted to the group method of teaching .....
    d. Because otherwise too much material would be spoiled .....
    e. Because best results are obtained after careful preliminary direction to the group .....
    f. Because immature boys learn best by imitation .....
12. What is done with the output of the shops of the school?
    a Who pays for the material used?
    b. Does the pupil take home what he makes?
    c. Does the shop make things for the school? To what extent?
    d. To what extent has the school made its own additional equipment from time to time or its own construction or alteration in plant if any?
    e. Has any of the output of the shops been sold?
13. What are the objections as you see them to the individual method of shop instruction in your school?
14. If the boy is to be made acquainted as much as possible with industry so that along with other things he is to go out "industry-wise, having a consumer's or director's

knowledge of tools, machinery, materials, processes, workmanship, output, shop problems and difficulties, and industrial economics," what changes if any, would you make in the present shop work in order better to accomplish this end?

a. Would you increase the amount of time given to the shop work? If so, how much?
b. Would you reduce the number of pupils per shop instructor?
c. Would you operate the shop on an exercise or a productive basis?
d. Would you have pupils make things to take home or would you have them make things to be utilized in the M. A. H. S. or other high schools or sold on the market?
e. Would you have pupils draw what they make and make what they draw?
f. Would you have them calculate the amount of dimension stock required on their work, its cost, the amount and value of their own time, and the value of the finished article?
g. Would you lay the emphasis on the job and the output or on the exercise and process which the pupil performs in making an article?

15. To what extent has the school brought its pupils through visitation of outside shops and the talks of successful manufacturers, foremen, and workmen into contact with the industrial activities of Boston?
16. Do you believe this should be done?
    If so how would you accomplish it?
17. How, if at all, is the drawing work connected with the shop work?
    a. Are drawings made of the objects or projects made in the shop by the boys who make them?
    b. Are drawings made for other boys to use in the shop?
    c. To what extent do boys work from blue prints of drawings made by others?
        (1) First year
        (2) Second year
        (3) Third year
        (4) Fourth year
    d. Are all the drawings made in the drawing room or are some of them made on the shop floor as shop sketches?

e. If drawings are made for the shops, who takes the responsibility for the checking of these drawings?
   (1) The shop instructor
   (2) The drawing room instructor

f. Who decides on what kind of drawings and what kind of projects shall be made in the different shops?
   (1) The individual teachers
   (2) The principal of the school
   (3) The head of the department

g. Are drawings made in order to create exercises in the shop or are exercises in the shop given to provide work in drawing?

h. What are the difficulties to be met in having the drawing serve the shop work and the shop work serve the drawing?

i. Is it feasible to closely connect the work of the shop and the drawing rooms and can one be made to serve the other better?

j. What suggestions have you to make in doing this?

18. What is the aim of your shop work?
   a. Is the aim fine technique and workmanship?
   b. Is it the plan to have a boy make a few things and make them very well or to make a large number of things in such a way as to give the boy a larger experience and insight into shop method and processes.
   c. Can both of these things be done in the time at your disposal?
   d. If time is too short, where, in your opinion, should the emphasis be laid between these two aims?

19. How many different pupils do your head shop instructors deal with in a week's time?
   a. The largest number
   b. The smallest number

20. Will you kindly furnish a list, which can easily be secured from the head shop instructors, of the things which the boys have made this school year in the first year, second year, third year, and fourth year?

21. At the same time will you kindly find out from these instructors the total number of each thing made?

22. What is the purpose of the shop work in the school?
   a. To furnish manual training as a part of a general education.
   b. To attract and hold boys who would otherwise not take a secondary school course.

c. To give needed and helpful preparation for technical college training to follow.
e. To develop the mind through the training of the hand.
f. To help boys carry on their book work better.

VI

The Drawing

1. What is the length of time devoted to free-hand drawing?
   a. First year
   b. Second year
   c. Third year
   d. Fourth year
2. What is the length of time devoted to machine drawing?
   a. First year
   b. Second year
   c. Third year
   d. Fourth year
3. What is the length of time given to architectural drawing?
   a. First year
   b. Second year
   c. Third year
   d. Fourth year
4. What is the smallest amount of industrial experience that is considered necessary for the teacher of each of these lines?
5. In general, how many of these instructors in drawing have had more than this minimum requirement in practical experience?
6. How long have these instructors been out of the trade?
7. What method is pursued to have them keep in touch with commercial practices?
8. Is the same preliminary course given for each line of work, free-hand, machine, and architectural drafting?
9. Is the beginning work in drawing the same for all boys?
10. At what point in the course do boys begin to specialize in the different kinds of drawing offered by the school?
11. Are these different kinds of drawing taught in different classes to different boys or are they taught in the same class to the same boys?
12. Kindly send instruction sheets, exercise book, or text, together with the sheets of drawings, tracings, and blue prints made by the pupils during the last school year.
    a. In the first year, second year, third year, and fourth year of the work.
13. Kindly indicate on each sheet the probable number of copies made by the pupil of each kind.

VITA

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Superintendent, Mailing Dept., Post Office, New Albany, Ind., 1908-09.

Instructor in Science, New Albany, Ind., 1899–1908.

Superintendent of Schools, New Albany, Ind., 1900–1908.

Judge, Juvenile Court, New Albany, Ind., 1904–08.

Superintendent of Schools, Children's Aid Society, New York, 1909–10.

Deputy Commissioner for Vocational Education for Massachusetts, 1910–12.

Secretary, National Society for the Promotion of Industrial Education, 1912–15.

Special Investigator, Mechanic Arts High School, Boston, 1913–14.

Member of National Commission on Federal Aid to Vocational Education, 1914.

Lecturer, Columbia University, 1914–15.

Member of Special Committee on Vocational Survey for Richmond, 1914.

Lecturer, Harvard Summer School, 1914.

Director, Minneapolis Educational Survey, 1915.

Director, Dunwoody Industrial Institute, Minneapolis, 1915—

Special Lecturer, University of Minnesota, 1915—

Member, National Censorship Board of Moving Pictures, New York Cty, 1909–10. Member, National Censorship Board for Moving Pictures,. 1914. Member, National Committee on Federal Constitution. Member, Special Committee on Vocational Education, National Education Association, 1913–15. Member, Board of Trustees, Italian American Society, 1910–11. Member, Advisory Board, Vocation Bureau, Boston.

Contributing editor to the following publications: Bulletins of U. S. Bureau of Education; Bulletins of U. S. Bureau of Labor Statistics; Manual Arts and Vocational Education Magazine; Educational Administration and Supervision.

General editor, American Book Company, Vocational Education series, 1915.

Writings

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