

**THE WORCESTER POLYTECHNIC INSTITUTE
DEFEATS THE INSTITUTE OF
TECHNOLOGY IN 1869:
“SHOP CULTURE” AND THE MAINSTREAM
OF RELIGIOUS TRADITION IN MASSACHUSETTS**

Akira Tachikawa

I

The present essay extends the author's study of the scientific institutions in 19th century Massachusetts to include the analysis of the Worcester Polytechnic Institute. Chartered in 1865 as the Worcester County Free Institute of Industrial Science (hereinafter referred to as the Free Institute), the Institute has since developed as a key technological institution in Massachusetts. In the following, the author interprets its early history within the same framework he has so far applied to the study of the Museum of Comparative Zoology, the Massachusetts Institute of Technology, and the Massachusetts Agricultural College: i.e., to understand their early history in the cultural context of 19th century Massachusetts.⁽¹⁾ The historians of the Free Institute depict its early history in terms of conflicts or tensions between the scientific and the practical, theoretical education and mechanical training, and the Boynton Hall and the Washburn Machine Shop.⁽²⁾ Although the author does not deny the significance of such an approach, he will herein ask, and hopefully answer, a different question relative to the early Free Institute, namely: Why could the Machine Shop of the Free Institute survive as its essential portion, in spite of severe criticisms from within the institution? To set up his question along this line, the author will compare the early history of the Free Institute with that of the Massachusetts Institute of Technology with special reference to State aid to the

former in 1869. In so doing, he would like to point out that what Monte A. Calvert termed "shop culture" had implications well beyond those felt by a limited circle of mechanical engineers in 19th century America.⁽³⁾

II

In the spring of 1869 the Massachusetts Institute of Technology, along with other infant scientific institutions, applied for State aid. Reporting the failure of its application to William B. Rogers, who was on sick leave from presidency, the acting President John D. Runkle stated the following:

. . . our bill for aid from the State has failed with the many others of the same class . . . All the applications were refused simply on the ground that the State tax is already very high and burdensome to the people.⁽⁴⁾

In part not to discourage Rogers, whose health was then rather unstable, Runkle either did not tell truth or excluded the pleas by two other schools from "many others of the same class." For this year the Massachusetts Agricultural College in Amherst and the Worcester County Free Institute of Industrial Science successfully obtained from the Commonwealth \$50,000 in aid, respectively.⁽⁵⁾ Why did the State give a subsidy to these two at the neglect of the Institute of Technology in Boston? Inasmuch as the legal and other status of the institutions as well as their past relations with the State in regard to financial aid could have mattered to the State's decisions in 1869, we should first compare the three scientific institutions from these points of view. The comparison will serve to pinpoint our query as to why the Free Institute defeated the Institute of Technology in their competition for State aid.

With reference to the organization and appointment of trustees, how did the Institute of Technology and the Agricultural College compare? On sharing the 1862 Morrill grant with the Agricultural College, the Institute of Technology added to its self-perpetuating members of the Board of Trustees

three State officers, "the governor, the chief justice of the supreme judicial court, and the secretary of the board of education."⁽⁶⁾ Although the College's board later underwent a modification, the appointment of its vacated trustees by the General Court indicated that the Agricultural College was a genuine state institution. This difference in legal status was reflected in the kind and extent of the State's aid to the two institutions during the 1860s and early 1870s. Since its opening in 1868 the Agricultural College enjoyed constant and ample aid from the Commonwealth. To give a few examples, the College received \$50,000 in 1868, \$50,000 in 1869, \$25,000 in 1870, \$50,000 in 1871, and \$25,000 in 1873, all from the State's treasury.⁽⁷⁾ Needless to say, this did not include the 1862 Morrill Act grant, of which the Agricultural College took the lion's share. In accordance with the 1861 Charter, the State granted the Institute of Technology a piece of land in the Back Bay area in 1863. For more than a quarter of a century thereafter, however, the Commonwealth did not extend any financial aid to the Institute.⁽⁸⁾ The Institute of Technology received three-tenths of the Morrill grant (c.\$70,000). But one could duly doubt if these moneys were part of State aid. Some of the Morrill grantees, including the States of Michigan and Wisconsin, only chartered "the university and acted as agent for the federal government in selling the lands,"⁽⁹⁾ a fate that befell the Institute of Technology in Boston. The Institute's status as recipient of the grant did not entitle her to State aid. In this sense, the State's 1869 decisions on subsidy to the Agricultural College, rather than the Institute of Technology, was by no means inconsistent.

Of course the actual roles of agriculture vis-à-vis industry offered different criteria for judging the State's actions in 1869. For all intents and purposes, the significance of agriculture had declined in post-bellum Massachusetts. From 1855, 1865, through 1870 the percentage of farmers over the total working population in the State decreased from 17%, 16% to 13%. In contrast, the same for those engaged in manufacturing, mechanical and

mining industries jumped from 37%, 41% to 51%.⁽¹⁰⁾ In terms of gross product, agriculture lagged far behind industry by 1870 when the former produced a total value of \$32,192,378 while the latter, \$553,912,568.⁽¹¹⁾ Given these data one could easily see the potential importance of technical education for mechanics and machinists, the cause for which the Institute of Technology and the Free Institute fought. Indeed, Governor Bullock expressed his high appreciation of the Institute of Technology in 1869, saying that it aimed “to meet the exigencies of this age with a broader scope than any other institution that has been established in the United States.”⁽¹²⁾ Nonetheless, the State aided only one of the two, the Free Institute rather than the Institute of Technology.

Now, with regard to its legal and other status, how did the Free Institute in Worcester contrast with the Institute of Technology in Boston? The Charter of the Free Institute of 1865 stipulated that its board of trustees should include the Mayor of the City of Worcester, together with another member to be appointed by the (state) board of education, while the board of trustees itself was to replace the rest.⁽¹³⁾ Again, the Free Institute did not charge tuition on those from within Worcester County.⁽¹⁴⁾ The Charter of the Institute of Technology emphasized its State-wide character in terms of its clientele, partly because it received from the State a piece of land in the Back Bay area. The 1861 Charter stated that “persons from all parts of the Commonwealth shall be alike eligible as members of said institute, or as pupils for its instruction.”⁽¹⁵⁾ During the 1860s, at least, the Free Institute clearly represented local interests while the Institute of Technology in Boston was a State-wide institution. Indeed, the geographical backgrounds of their early students reflected this difference. As table 1 shows, right from the beginning the Institute of Technology attracted students not only from nearby counties but also from distant counties as well. Moreover, those from other states constantly increased, making up some one-fourth of the total enrollment by 1870. In contrast, more than 90 percent of the Free

Institute clientele came from within Worcester County in 1870 when it had already opened its classes for two years. In the following year, those from other counties markedly increased, but this was largely due to the 1869 State grant which had obliged the Free Institute to invite, free of tuition, several students from other counties as well.⁽¹⁶⁾ On top of this, since its opening in 1865, the Institute of Technology had enrolled four full years of pupils, while the Free Institute had taught its students for only a few months when it applied for State aid in 1869. One thing seems obvious. The State of Massachusetts granted \$50,000 in aid to the small Free Institute in spite of its apparently local character. Exactly the opposite may be said of the Institute of Technology. It did not get the State's response despite its manifest contribution to the cause of industrial education on a state-wide level. Thus the stage was set for the comparison of the two. Suppose that the Free Institute's victory in 1869 derived only in part from the influence of a few powerful politicians,⁽¹⁷⁾ what were the elements of the Free Institute that induced the State aid despite her clearly provincial character?

**TABLE 1:
GEOGRAPHICAL BACKGROUND OF M.I.T. AND W.C.F.I. STUDENTS**

	M.I.T.					W.C.F.I.	
	1866	1867	1868	1869	1870	1870	1871
Barnstable Bristol Dukes Nantucket Plymouth	8	10	15	19	16	1	2
Norfolk Suffolk	59	61	66	74	79	0	1
Essex Middlesex	38	55	50	66	60	0	4
Worcester	5	11	7	1	4	74	64
Berkshire Franklin Hampden Hampshire	2	3	2	2	2	2	3
Other New England States	8	11	12	17	21	3	5
Other States and Foreign Countries	18	14	17	26	35	2	9
Total	138	165	172	205	218	82	89

Sources: *Annual Catalogues of the Massachusetts Institute of Technology*, 1866-67, 1867-68, 1869-70, and 1870-71; *First Annual Catalogue of the Worcester County Free Institute of Industrial Science*, 1870-71. *The Second Annual Catalogue . . .*, 1871-72.

III

No two technical schools in 19th century Massachusetts were seemingly more similar than the Free Institute and the Institute of Technology. Both aimed at the training of youngsters for the active spheres of social life, industrial production and transportation, as engineers, machinists, architects and so on. In order to do this, both emphasized, in their educational programs, modern scientific subjects, especially the purely physical sciences represented by physics and chemistry. The first teaching staff at the Institute of Technology consisted of ten members; three who took charge of engineering as well as four who taught the purely physical sciences, flanked by two who taught the modern languages.⁽¹⁸⁾ At the Free Institute three taught physics, chemistry, mathematics, one, engineering, one, drawing, and one, the modern languages.⁽¹⁹⁾ Again, their courses of instruction were similar. The School of Industrial Science of the Institute of Technology comprised five courses: Mechanical Construction and Engineering, Civil and Topographical Engineering, Building and Architecture, Practical and Technical Chemistry, and Practical Geology and Mining.⁽²⁰⁾ The Free Institute's program included six major branches: Mechanical Engineering, Civil Engineering and Topography, Architecture, Drawing and Design, Chemistry, and the modern languages.⁽²¹⁾ No wonder, to the contemporary, the two institutions were objects of comparative study.⁽²²⁾ Indeed, as we will see later, when they delivered speeches in the State House in support of the Free Institute's plea in 1869, George Hoar and Emory Washburn, invariably set the Free Institute against the Institute of Technology to elucidate the distinct merits of the former worthy of the State's attention. The Institute of Technology, in many ways, set standards the Free Institute had to emulate.

This granted, there were a few significant differences between the two. In the following the author will discuss, first, the distinctive organization of

the trustees of the Free Institute vis-à-vis the Institute of Technology. This concerns the leading roles of clerical elements in the founding and management of the early Free Institute. Then, he will set focus upon the salient educational facility of the Free Institute, the Washburn Machine Shop. The historians often locate the Shop at the other extreme from the educational ideals promoted by the clerical elements mentioned above. The author will argue that the Machine Shop in fact served not only to distinguish the Free Institute from the Institute of Technology, but also to buttress those very ideals in a fundamental way.

On May 10, 1865 a group of men from Worcester successfully obtained from the State a Charter for the Worcester County Free Institute of Industrial Science. This Charter in fact evolved from a prototype which was prepared earlier and had been discussed in the General Court until the beginning of April of that year. For the sake of convenience, let us designate this prototype as "P-C", which is found in the Archives of the Commonwealth. In an unusually long sentence, the first section of P-C defined the governing body of the proposed Free Institute in these terms:

George F. Hoar, Seth Sweetser, their associates and successors, not to exceed twelve in number, at any one time, of whom the Mayor of the City of Worcester for the time being shall, ex-officio, be one, one shall be chosen or appointed by the Board of Education from time to time as a vacancy shall occur, and three shall be selected from the ministers or pastors ordained and in regular standing of three different denominational churches or religious societies in Worcester, viz. an Orthodox Congregational, a Baptist and a Unitarian society . . . (23)

The first section of the Charter which passed the legislature in May, 1865 read:

. . . The Mayor of the City of Worcester, for the time being, shall, ex-officio, be a member of said corporation, and one member shall be appointed by the board of education, from time to time, as a vacancy

may occur; and said corporation shall not consist of more than twelve members at any one time.⁽²⁴⁾

The major difference between P–C and the Charter lay in the specifications on the clerical portion of the board, which disappeared entirely in the latter. The contrast was striking, since P–C paid utmost care to secure the participation of active clerical elements in the control of the proposed Free Institute. As a result, the board of trustees now bore seemingly secular features. Nevertheless, the modification was only superficial.

The origin of these specifications dated back, at least, to the letter of donation which initially enabled the move to found the Free Institute. John Boynton, a retired Templeton manufacturer, had arrived in Worcester around the beginning of 1865 with a determination to donate the major portion of his fortune, \$100,000, for the establishment of a free school for youths with a practical career in view. Partly because Boynton was not very literate, Seth Sweetser, a Congregational minister and a key figure of the early Free Institute, wrote Boynton's communication of donation. A few of those committed to the Free Institute, to say nothing of Sweetser himself, knew its contents very well long before the letter was officially disclosed on May 13, 1865, immediately after the Charter was obtained from the State.⁽²⁵⁾ In this letter "Boynton" stated:

The oversight of this institution shall be in a board of twelve trustees, constituted as follows: The Mayor of the City of Worcester, for the time being, shall always be one; one shall be appointed by the Board of Education of Commonwealth of Massachusetts; three shall be pastors of churches in the city of Worcester, of three different religious denominations, namely: The Orthodox Congregationalist, the Baptist and the Unitarian . . .⁽²⁶⁾

There was an unmistakable parallelism between Boynton's letter of donation and P–C with special reference to the specifications on clerical repre-

sentation. Indeed, P-C was no more than an elaboration of "Boynton's" statement.

As could be expected, despite the disappearance of these specifications in the Charter, the Free Institute perfectly followed them by selecting three ministers among the twelve trustees. Seth Sweetser, one of the two original incorporators, represented the Congregational church, while two other ministers selected were Alonzo Hill, pastor of the First Unitarian Church, and Hiram K. Pervear, pastor of the First Baptist Church.⁽²⁷⁾ On the other hand, the trustees characteristically included only one engineer, Phineas Ball, who happened to serve on the board, *ex officio*, in his capacity as Mayor of Worcester!⁽²⁸⁾ All this indicates that some of those committed to the proposed Free Institute, including Sweetser, held from the very start of the Free Institute movement a scheme of a scientific and engineering school which was under the firm control of the dominant Protestant churches in Worcester.

This clerical representation in the trustees did not find any parallel in the Institute of Technology in Boston. The original incorporators of the Institute did not include any minister. Among some two hundred members who promoted the incorporation of the Institute of Technology in 1861, there were numbered six eminent clergymen in Boston. Except one or two, however, they were retired Unitarian ministers. Moreover, they did not play any active role in the organization of the Institute's academic and other programs. The scientist William Barton Rogers, the founder, drew up the major outlines of the new institution by himself from *Objects and Plan of an Institute of Technology* (1861) through *Scope and Plan of the School of Industrial Science of the Massachusetts Institute of Technology* (1864). In contrast, Rev. Sweetser virtually drafted two of the most important documents for the founding of the Free Institute, John Boynton's letter of donation, as well as another letter of equal significance by Ichabod Washburn, a Worcester industrialist, who contributed to the Free Institute

the ideas and resources of a machine shop.⁽²⁹⁾ Again, two ministers, Sweetser and Alonzo Hill, initially planned, along with two other trustees, a program of study of the Free Institute.⁽³⁰⁾ Its first committee for a public oral examination of students in 1870 consisted of seven examiners of which three were clergymen from Templeton and Worcester.⁽³¹⁾

With regard to the basic orientation of Boynton's proposals on educational matters, Sweetser seems to have equally exerted his influence to strengthen its Christian tenet. Among others, the Boynton letter pointed to the ideal atmosphere in which the proposed institution should train its students in practical and technical subjects:

Whereas . . . the Statutes of the Commonwealth contain the following article, "It shall be the duty of the president, professors . . . to impress on the minds of . . . youth the principles of piety, justice, and a sacred regard to truth, love to their country, humanity and universal benevolence, sobriety, industry, frugality, chastity, moderation and temperance . . ." it is therefore enjoined upon the Trustees to see that these provisions are faithfully applied in this school, and that, while all sectarianism . . . is strictly prohibited, the Bible, in the authorized version, shall be in daily use, and such devotional exercises as consist with a due sense of our dependence upon the divine blessing.⁽³²⁾

In its emphasis upon Christian tradition, the Boynton letter invoked the publicly-sanctioned purposes of education in Massachusetts. At the conclusion of his statement, Boynton set it as the educational goal of the proposed school to produce "useful citizens, not only well-versed in the sciences and arts, but also, persons of good morals, who will lead upright and honest lives in the light of God and man."⁽³³⁾

Given the religious orientation in the Boynton letter, as well as the major purpose of training engineers, the Free Institute confronted a challenge: how to accomplish the dual task of providing a most efficient technical education and of conducting its students to religiously-oriented

morals? At the very opening of the Free Institute, Charles O. Thompson, its first principal, was quite aware of this, although he did not fully answer the query then. In his inaugural address in November 1868, Thompson illustrated the unique role of the newly-opened Institute by locating it in the third of what he depicted as the three phases of American educational history. According to him, the first phase originated in the arrival of the Puritans and persisted until the early nineteenth century, wherein the church dominated the school. The smartest boys entered college ultimately to become ministers, and the less so went into trade. Then followed the second phase which almost reversed that direction by emphasizing mathematics, science, and other modern subjects with a contempt for the classical tradition. The Institute of Technology in Boston represented the latest "expression of this new opinion, and one of the noblest." But, it was too expensive, while other scientific schools connected with colleges were too theoretical. The third and current phase of historical development, where more ordinary boys would have to be taken care of, entailed the reconciliation of the first two elements. In other words, schools now should teach boys wisdom as much as intelligence. This was particularly vital, since the strength of the nation rested with "an increase of intelligence controlled by religious principle."⁽³⁴⁾ Thus, in Thompson's argument, the Free Institute was supposed to synthesize the two extremes of the previous phases, preoccupations with religious tradition and with trade, in its new educational programs. But, how should it accomplish this?

The early educational buildings of the Free Institute were impressively provided, in their midst, with spacious chapels. The Boynton Hall had one which was "capable of seating 400 persons."⁽³⁵⁾ The Washburn Machine Shop had another chapel on the third floor adjacent to a drawing room.⁽³⁶⁾ From the beginning of the Free Institute, students were required to attend chapel in the evening each day of the week except Sunday. These regulations gradually slackened until 1892 when attendance was made volun-

tary.⁽³⁷⁾ Nevertheless, as late as June, 1884, a committee of the Trustees passed a resolution, confirming the following:

(1) that such (chapel) exercises be held on every day of full and regular work of the Institute; (2) that the presence of all students is required at these exercises; but (3) that the Principal is empowered to excuse from attendance such individual students, or divisions of the school, as the necessities of the case, may in his judgement, from time to time demand.⁽³⁸⁾

This emphasis upon religious elements, notwithstanding, one may duly wonder whether or not the early Institute actually *synthesized* religious and trade education. Did not the Free Institute simply juxtapose one along the other in a mechanical manner?

IV

It is precisely here that a unique element of the Free Institute, the Machine Shop, attracts our attention. Ichabod Washburn, a Worcester industrialist and deeply religious man (hence he was commonly referred to as "Deacon Washburn"), had already long entertained ideas of practical education when the Free Institute proposal surfaced in March, 1865. Since the Boynton plan was to him no more than another "theoretic school, one more academy to struggle for life,"⁽³⁹⁾ Washburn proposed, and his proposal was accepted by the Trustees, to give the new Institute something quite practical: a Machine Shop for the training in mechanical engineering. This practical aspect should not make one blind to another feature of the Machine Shop as articulated by Ichabod Washburn in his letter of gift and instructions. Partly because Rev. Sweetser exerted influence upon this communication, but more importantly because it reflected, as will be discussed later, Ichabod Washburn's cherished experiences as apprentice, part of this practical proposal had a religious flavor. Washburn commenced his long letter as follows:

I have long been satisfied that a course of instruction might be adopted in the education of apprentices to mechanical employments, whereby moral and intellectual training might be united with the processes by which the arts of mechanism, as well as skill in the use and adaptation of tools and machinery are taught . . . it renders them (mechanics) better and more useful citizens, and so more like our Divine Master, whose youth combined the conversations of the learned with the duties of a mechanic's son, and whose ideas and teachings now underlie the civilization of the world.⁽⁴⁰⁾

Then how could the Free Institute materialize these ideas, especially the unification of "moral and intellectual training" as well as the acquisition of mechanical skills? Washburn's answer consisted in the establishment of a Machine Shop for which he was ready to construct a building and to provide necessary tools and funds. In terms of personnel, the Shop was to include a superintendent, a few practical teachers and workmen, and twenty or more apprentices who were students of the mechanical department. The practical teachers or workmen were to manufacture goods as well as to teach apprentices "in all the departments of practical mechanism." To be admitted, apprentice students had to be men of "good moral character." They were expected to enter into "a solemn and satisfactory obligation . . . (and to) conduct themselves agreeably to the rules and regulations of the shop." Above and by the side of these workmen and apprentice students stood superintendent. A man of "good morals and Christian character," he was to take responsibility for the general management of the Shop. But, did the management require "Christian character" on the part of the superintendent? Certainly not, if just for that purpose. The qualification actually counted, because he was supposed to "have a care and oversight over the apprentices, such as a faithful master would exercise, to the end that they may cultivate habits of industry, good conduct, and attention to their studies, and observe all reasonable rules of discipline, and moral

training.”⁽⁴¹⁾ In short, he was the supervisor and guardian of mechanic students (in number they dominated the early Free Institute⁽⁴²⁾), on every aspect of their life, study, work, and morality.

Despite the emphasis upon moral training, the Machine Shop continuously provoked criticism and opposition from some of the promoters of the Free Institute. In September, 1865, Stephen Salisbury, the first president of the Board of Trustees, worried that Ichabod Washburn's Shop “would be the leading operation of the institute.”⁽⁴³⁾ Similarly Rev. Sweetser, even after the death of Ichabod Washburn, feared the practical orientation of the Machine Shop. “The Shop is a business establishment and not a school,” stated Sweetser in 1869. “My first plan when I talked over the matter with Deacon Washburn years ago, was to have a shop, but to arrange with existing shops in the city to take in ten boys at certain hours as apprentices.”⁽⁴⁴⁾ In the face of such criticism and opposition from among its major promoters, how could the Machine Shop not only survive, but even develop, as the key element of the Free Institute? As early as late 1868, when the Free Institute had barely started, its protagonist was gone. Indeed, in his letter of donation, Ichabod Washburn stated that the Trustees could discontinue the Machine Shop, when they found it unworkable, and transfer the funds therefor, preferably, to the department of mechanical engineering of the Free Institute.⁽⁴⁵⁾

Who supported the Machine Shop then? Charles O. Thompson, the first principal, seems to have been one of those in its favor. Thompson devoted much of the first pages of the Second Annual Catalogue of the Free Institute to the explication of the nature and role of the Machine Shop which gave “special prominence to the element of practice.” Amidst a sea of failures of manual training programs, the Institute's Machine Shop proved success. How could this occur? According to Thompson, failures of manual training programs stemmed from two major causes: “an imperfect comprehension of the true relations of this element in technical training, and . . . an

inadequate investment of capital.”⁽⁴⁶⁾ Owing to the Washburn funds for the Machine Shop, the Free Institute’s program was relatively free from the second. The breakthrough of the first difficulty lay in the following. Prior to their shop experiences, all the junior (= 1st year) students at the Free Institute spend eight hours a week in free-hand drawing, thereby improving their abilities in observation and drawing. The Machine Shop which they then entered employed “a full quota of skilled workmen . . . so that, as a shop, it is completely independent of the students.” The latter always entered the Shop where the workmen had already been doing some work, and “those in their turn either acted as instructors or worked on where they were most needed.”⁽⁴⁷⁾ Here, the roles of workmen were not simply those of instructors, since they produced saleable commodities. Nor were their roles simply those of workmen, since they taught from time to time the apprentice students, who in turn had received, in other branches of the Institute, training in those subjects basic to mechanical work. “The determination on the part of the Superintendent to maintain the highest standard of workmanship,” concluded Thompson, “has so far been successfully carried out, and is undoubtedly the only way to fulfill the design of the shop.”⁽⁴⁸⁾ Here was a favorable interpretation as well as an implementation of Washburn’s proposals, which was theoretically precise, but which was somewhat deficient in historical and political explanation.

Another kind of support, which comprised political and historical elements, came from two spokesmen of the Free Institute for the 1869 State aid: George F. Hoar, an original corporator and U.S. Congressman, and Emory Washburn, a trustee and Harvard Law School professor. In the State House, Hoar made a case for the Free Institute by pointing to the training of the forgotten portion of the people on Massachusetts, that “class of her children who go into the shops,”⁽⁴⁹⁾ to which the Institute now extended her arms. Such training ought to be the State’s grave concern, since this class of people actually mediated scientific discoveries and

practical improvements in production, thereby assuring prosperity of the nation. Some might argue that the Institute of Technology in Boston was exactly for that purpose. But, in fact the Institute of Technology did not teach boys to go back to work in the shop. The Free Institute would and could encourage them to do so, or to “work their way up from the journeyman to the foreman, and then the master mechanic.” It could do this, where the Institute of Technology could not, precisely because the former was equipped with “a machine shop . . . where they are expected to work some three or four hours each day.”⁽⁵⁰⁾ Thus Hoar located the Machine Shop at the center of the Free Institute in his efforts to emphasize its distinct and vital roles before the Massachusetts State House.

Similarly, Emory Washburn, ex-governor of the State, pointed to the educationally neglected class of Massachusetts: “the operative classes in our manufacturing and mechanical shops.” Neither the Lawrence Scientific School nor the Institute of Technology could cater for these classes, for they were too expensive for them. Only the “Free” Institute could train young men from these classes to keep them “where they are most needed, at home, to build up and maintain the prosperity of the Commonwealth.”⁽⁵¹⁾ The Law School Professor found such training particularly significant in the light of the increasingly conspicuous contest between capital and labor which had been disturbing “business . . . in almost every manufacturing place in the State.”⁽⁵²⁾ This sinister tendency, which was none of “the natural fruit of New England culture,” would have to be curbed by any means. The Free Institute in Worcester would offer the perfect answer. It would *educate* sons of the operative classes for the work in the *shops*. For when uneducated, these people were not only inefficient, but also very much inclined to strikes. When educated in the Institute of Technology, on the other hand, they would evade dirty work shops, although they were immune to strikes. Massachusetts needed educated mechanics who were willing to go back to the shops, the seat of her eco-

conomic prosperity. Where should the Commonwealth turn other than to the Free Institute, with its Machine Shop, for such education?

To Emory Washburn, "educated" apparently had nothing to do with having read the *Communist Manifesto*. Rather, it was more character-oriented, with special reference to hard work and independence. It was in this context that he expressed his hope before the graduating class of the Free Institute in 1873 that, in the midst of mounting strikes and sabotages, "this school is yet in time to do something to bring back Massachusetts to her primitive condition of sterling honor, where no man was ashamed to work."⁽⁵³⁾ He thought he could locate the ideal "educated mechanics", in distinction to "inferior workmen" of his times, in the golden age of the Commonwealth.

How did the legislature respond to their appeals? The Committee on Education confirmed the major points George F. Hoar and Emory Washburn had set forth. Its report did not specifically mention the contest of capital and labor, a topic which was too political, perhaps. The Committee, however, noted the origins of the Free Institute with reference to the "munificent contributions of two eminent mechanics who had felt the need of scientific education in their struggles from obscurity and poverty to distinction and fortune." Partly reflecting the two trustees' arguments, the report evaluated Ichabod Washburn's contribution as "equal to that of Mr. Boynton."⁽⁵⁴⁾ The Committee must have understood, the author believes, that such a school could be promoted best when founded by the operative classes themselves upon their recognition of its necessity.

Hence it is the final task of this essay to trace the origins of the Machine Shop in relation to Ichabod Washburn's apprenticeship in earlier Massachusetts. How did he conceive the Machine Shop? His ideas seem to have derived largely from his personal experience in youth. At the age of seventeen, Ichabod Washburn apprenticed to a master, Nathan Muzzy, at Leicester to learn tin and metal work, and, on the master's removal to Auburn,

followed him. To be sure the larger part of experience as apprentice was less than exciting. "I had nothing to do but to work from sunrise to sunset," he stated in his autobiography. But, he added, "I often recur to that period and place, where I had quite as much profitable reflection as during any portion of my apprenticeship." Moreover, the master, a deeply religious man, "honestly fulfilled his contract with me, and took a special interest in my spiritual welfare." A man esteemed "as a useful village blacksmith," he later became Ichabod Washburn's close friend as "one of the deacons of the Union Church in Worcester."⁽⁵⁵⁾ All this lay behind Ichabod Washburn's cherished ideas of vocational education: hard work, leading youth to the sense of significance as a social being, and the faithful relationship of the master and apprentice, often conducive to a spiritual life. Only in this way can one appreciate the ideas Washburn tried to incorporate into the Machine Shop plans: the integration of moral and intellectual training as well as the mastery of mechanical skills, which would render mechanics "more like our Divine Master."⁽⁵⁶⁾

In advocating the "novel" Machine Shop, the Free Institute partly identified itself with the traditional mode of relationship of production of artisans, who in turn were significant part of holders of traditional faith in the State. It was not accidental that the Free Institute opened in Worcester, a city which was industrializing rapidly, but which simultaneously remained religiously conservative in the mid-nineteenth century.⁽⁵⁷⁾ Although it was in many ways local, the Free Institute stood much closer to the mainstream of the State's cultural tradition than the Institute of Technology in Boston did. This partly contributed to offering an apparently better solutions to the now acute contest of capital and labor in Massachusetts. No wonder the Commonwealth aided the Free Institute in 1869, to the neglect of the Institute of Technology which was more state-wide in its characteristics.

In connection with the later development of engineering education, Monte A. Calvert has rightly located the Free Institute on the side of "shop

culture” vis-à-vis the Institute of Technology which represented “school culture.” With the gradual preponderance of “school culture” over “shop culture”, the Free Institute had to succumb, in part, at least, to the influence of the Institute of Technology. Nonetheless, their early history can be written from a different perspective as well. Within a broader context of 19th century Massachusetts, the Free Institute presents a picture distinct from that of the Institute of Technology in its proximity to the declining but still dominant religious tradition. This partly explains why the Machine Shop survived as the major element of the Free Institute.

FOOTNOTES:

- (1) See my "The Founding of the Museum of Comparative Zoology in the Educational Crisis of mid-nineteenth Century Massachusetts." *ICU Educational Studies*. XXII (1979); "The Founding of the Massachusetts Agricultural College: An Interpretation." *ICU Educational Studies*. XXVI (1984).
- (2) See, for instance, Mildred M. Tymeson. *Two Towers: The Story of Worcester Tech, 1865-1965*. Worcester, 1965; George I. Rockwood. *The Founder of the Worcester Polytechnic Institute*. Worcester, 1943.
- (3) See Monte A. Calvert. *The Mechanical Engineer in America, 1830-1910*. Baltimore, 1967, Chapter 4; David F. Noble. *America by Design: Science, Technology, and the Rise of Corporate State*. New York, 1977, p. 26.
- (4) Emma Rogers ed. *Life and Letters of William Barton Rogers. II*. Boston, 1896, p. 288.
- (5) See *Acts and Resolves, passed by the General Court of Massachusetts, in the year 1869*. Boston, 1869. Resolves, Chapters 34 and 57.
- (6) An Act in Addition to the Act to Incorporate the Massachusetts Institute of Technology. 1863, Chapter 186, Section 2.
- (7) See (Massachusetts) 1868 Resolve Chapter 30; 1869 Resolve Chapter 34; 1870 Resolve Chapter 75; 1871 Resolve Chapter 89; and 1873 Resolve Chapter 55.
- (8) Robert H. Richards. *His Mark*. Boston, 1936, p. 90n.
- (9) John S. Whitehead. *The Separation of College and State*. New Haven, 1973, p. 134.
- (10) See The Census of Massachusetts, 1855, 1865; *A Compendium of the Nineth Census* (1870). Wash. D.C. 1872, pp. 594-95.
- (11) See *A Compendium of the Nineth Census*. pp. 692 and 799.
- (12) "Governor Bullock's Address." In Worcester County Free Institute of Industrial Science. *Addresses of Inauguration and Dedication*. Worcester, 1869, p. 95.
- (13) See An Act to incorporate the Worcester County Free Institute of

- Industrial Science. 1865. Section 1. (Archives of the Worcester Polytechnic Institute.)
- (14) See *The First Annual Catalogue of the Worcester County Free Institute of Industrial Science, 1870-71.* p. 11; Herbert F. Taylor. *Seventy Years of the Worcester Polytechnic Institute.* Worcester, 1937, p. 107.
 - (15) An Act to incorporate the Massachusetts Institute of Technology, and to grant aid to said Institute and to the Boston Society of Natural History. (Massachusetts) 1861 Act Chapter 183, Section 4.
 - (16) See (Massachusetts) 1869 Resolve Chapter 57.
 - (17) Cf. George F. Hoar. *Autobiography of Seventy Years.* I. New York, 1903, p. 167.
 - (18) See Samuel C. Prescott. *When M.I.T. was "Boston Tech", 1861-1916.* Cambridge, 1954, pp. 50-51.
 - (19) *The First Annual Catalogue of the Worcester County Free Institute ...* p. 4.
 - (20) See (William Barton Rogers.) *Scope and Plan of the School of Industrial Science of the Massachusetts Institute of Technology.* Boston, 1864, p. 10.
 - (21) See *The First Annual Catalogue ...* p. 6.
 - (22) See Massachusetts Charitable Mechanic Association. *Report of a Special Committee on the "Province of the Association as an influence upon our Industrial and Social Life."* Boston, 1874, pp. 5-9.
 - (23) MS. Bill to incorporate the Worcester County Free Institute of Industrial Science. April, 1865. (Archives of the Commonwealth), p. 1.
 - (24) An Act to incorporate the Worcester County Free Institute ... p. 2.
 - (25) See Rockwood. *op. cit.*, p. 4.
 - (26) "Letter of Gift and Instructions from John Boynton, Esq." In Worcester County Free Institute of Industrial Science. *Addresses of Inauguration and Dedication.* Worcester, 1869, p. 10.
 - (27) As for the lives and works of these ministers, see: Rev. Egbert C. Smyth. *Sketch of Rev. Seth Sweetser, D.D.* Boston, 1878; Alonzo Hill. *The Pastor's Record: A Sermon ... on the Fortieth Anniversary*

of his Settlement. Cambridge, 1867; Taylor. *op. cit.*, p. 24.

- (28) See Taylor. *op. cit.*, p. 23.
- (29) See Rockwood. *op. cit.*, p. 12.
- (30) See Taylor. *op. cit.*, pp. 41-42.
- (31) See *The First Annual Catalogue . . .* p. 7.
- (32) "Letter of Gift and Instructions from John Boynton, Esq." p. 11.
The original letter which is kept in the Archives of the Worcester Polytechnic Institute, fully transcribes GEN. STAT. CHAP. 38 SEC. 10. See its pp. 73-75.
- (33) "Letter of Gift and Instructions . . ." p. 12.
- (34) "Address by Charles O. Thompson." In Worcester County Free Institute of Industrial Science. *Addresses of Inauguration and Dedication*. p. 72.
- (35) *The First Annual Catalogue . . .* p. 10.
- (36) See several leaves of the floor plans of the Washburn Machine Shop kept in the Widener Library, Harvard University. (# Educ U 8245.50).
- (37) MS. Zelotes W. Cooms. *The History of the Worcester Polytechnic Institute*. 192?. (Archives of the Worcester Polytechnic Institute.) "Chapel Exercises." p. (1).
- (38) Worcester Polytechnic Institute. *Charter, By-Laws, Deeds of Gifts, Names of Officers and Committees of Trustees and Other Memoranda*. Worcester, 1888, p. 11.
- (39) Arthur Bronwell. *W.P.I.: Cultivator of Yankee Ingenuity*. (The Newcomen Society of North America.) New York, 1957, p. 10. (A copy is at the American Antiquarian Society, Worcester.)
- (40) "Letter of Gift and Instructions from Hon. Ichabod Washburn, to Establish the Machine Shop and Working Mechanical Department of the Institute." (March 6, 1866). In Worcester County Free Institute of Industrial Science. *Addresses . . .* p. 17.
- (41) *Ibid.*, p. 18.
- (42) Of the 72 graduates of the early Free Institute (1871-1874), 33, or 46%, were from the department of mechanical engineering. The department of civil engineering sent out 26, or 36%, and that of chemistry, 5, or 7%, and other departments, 8, or 11%. See Cooms.

- op. cit.*, p. (15) "Classified Summary of Graduates, July, 1, 1926."
- (43) Stephen Salisbury to Emory Washburn, September 22, 1865. As quoted in Rockwood. *op. cit.*, p. 19.
- (44) Seth Sweetser to Milton P. Higgins, March 31, 1869. As quoted in Cooms. *op. cit.*, "The Washburn Shops." p. (4).
- (45) "Letter of Gift and Instructions from Hon. Ichabod Washburn, to Establish the Machine Shop . . ." p. 21.
- (46) *The Second Annual Catalogue . . .* p. 5.
- (47) *Ibid.*, pp. 6-7.
- (48) *Ibid.*, p. 7.
- (49) George F. Hoar. *Claims of the Free Institute of Industrial Science . . .* (February 11, 1869). (Archives of the Worcester Polytechnic Institute.) p. 3.
- (50) *Ibid.*, pp. 9-10.
- (51) Emory Washburn. *Address of Ex-Governor Emory Washburn before the Legislative Committee . . .* (February 11, 1869), Worcester, p. 8.
- (52) *Ibid.*, p. 6.
- (53) Emory Washburn. "Commencement Address." In Worcester County Free Institute of Industrial Science. *Commencement, July 30, 1873.* Worcester, 1873, p. 9.
- (54) MS. Report of the Committee on Education relative to the petition of the Worcester County Free Institute of Industrial Science. March 9, 1869. (Archives of the Commonwealth), p. 5.
- (55) Henry T. Cheever ed. *Autobiography and Memorials of Ichabod Washburn.* Boston, 1878, pp. 33-35.
- (56) On this point, see also: Charles O. Thompson. *The Worcester Plan for the Technical Education of Mechanics.* Boston, 1878, p. 10; George I. Alden. *Technical Training at the Worcester Free Institute.* (188?) (The State Library of Massachusetts), p. 6. As for the educational implications of apprenticeship in early 19th century America, see Paul H. Douglas. *American Apprenticeship and Industrial Education.* New York, 1921, pp. 49-56.
- (57) According to the 1855 and 1865 State Censuses, Worcester residents who engaged in the respective occupations as percent of Massachusetts

residents who engaged in the same were as follows:

	1855	1865
Worcester Co. Population	13.2	12.9
Agriculture	16.7	19.9
Factory Operatives	34.2	24.1
Laborers	12.2	12.6
Mariners & Boatmen	0.3	0.3
Manufacturers	14.4	21.1
Mechanics	15.1	14.5
Merchants	7.1	7.3
Professional Men	11.4	11.2
Miscellaneous	9.1	7.8

Agriculture, Factory Operatives, Manufacturers, and Mechanics were over-represented in Worcester in proportion to the percentages of her population in Massachusetts: 13.2% in 1855 and 12.9% in 1865.

The following table indicates Congregational church accommodations in a few counties as percent of those of Massachusetts:

	1850	1860	1870
Worcester Co. Population	13.2	13.0	13.2
Congregational Church Accommodations	17.6	14.2	15.0
Suffolk Co. Population	14.5	15.7	18.6
Congregational Church Accommodations	6.0	7.7	9.0
Middlesex Co. Population	16.2	17.6	18.8
Congregational Church Accommodations	13.4	12.3	13.9
Essex Co. Population	13.2	13.5	13.8
Congregational Church Accommodations	14.3	15.1	16.0

In 1850 Congregational church accommodations in Worcester County were very much over-represented in proportion to its population in Massachusetts. 17.6% marked the highest among the fourteen counties, making Worcester *the* Congregational County of the State. By 1870

the position, Essex took over showing a relative decline of this denomination in Worcester.

Sources: *The Seventh Census of the United States*. Wash., 1853, p. 61; *Statistics of the United States: The Eighth Census*. Wash., 1866, p. 408; *The Statistics of the Population of the United States: The Ninth Census. Vol. I*. Wash., 1872, p. 542.

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