Formative influences of engineering extension on industrial education at Iowa State College

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FORMATIVE INFLUENCES OF ENGINEERING EXTENSION ON INDUSTRIAL EDUCATION AT IOWA STATE COLLEGE

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Formative influences of engineering extension on industrial education at Iowa State College

by

Erik Lokensgard

Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Major: Industrial Education and Technology

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For the Graduate College

Iowa State University

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1986

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INTRODUCTION

Following the Civil War, American society underwent a fundamental and rapid transformation in which a predominantly rural life-style gave way to an urban-industrial orientation. The changes accompanying this shift affected Americans in almost all aspects of their lives. One historian, speaking of the 40 to 50 years preceding 1914, asserted, "Seldom, if ever, in American history had so much been altered within the lifetime of a single man."(1)

The dramatic rise of manufacturing in the last half of the 19th century gave major impetus to this re-shaping of American life.(2) Mass transit and transcontinental roadroads altered the way people and goods moved throughout the nation. Cities grew rapidly as large industries drew workers from the farms into booming cities. While only 16 cities numbered over 50,000 in 1860, by the turn of the century this number grew to 109.(3) Mass production led to
the establishment of huge factories, employing large numbers of workers. The majority of those urban proletarians took jobs requiring low skills, but the demand for skilled craftsmen also grew rapidly. According to one estimate, positions for skilled craftsmen and supervisors grew at the rate of 117,000 jobs per year between 1900 and 1920. (4)

In response to the industrial growth, educators placed increasing attention on vocational and technical education. Many educators favoring systematic vocational education joined the National Society for the Promotion of Industrial Education and helped win the passage of the Smith-Hughes Act in 1917. The incentive of federal funding helped cause the rapid growth of vocational and technical education in almost every section of the country.

Historians studying the rise of wide-spread vocational education have disagreed about its value. Some, mainly those directly involved in vocational education such as Charles A. Bennett and Melvin L. Barlow, have portrayed its development as a needed and valuable improvement in American society. This type of history has received the designation "hortatory, designed to elicit support for vocationalism in the public schools." (5)
In contrast to the missionary approach of the hortatory historians, a number of historians have tied vocational education to other educational changes, focusing on conflicts arising between democratic ideals and educational efficiency. (6) Ellwood Cubberley, a professor at Stanford University wrote in 1909, "Our city schools will soon be forced to give up the exceedingly democratic idea that all are equal, and that our society is devoid of classes, ... and to begin a specialization of educational effort along many new lines in an attempt better to adapt the school to the needs of these many classes in the city life." (7) In his renowned The Technological Society, Jacques Ellul singled out vocational guidance for criticism, asserting that it "represents a totalitarian takeover of the young." (8) It appeared to him as a device which "deprives man of freedom and responsibility, makes him into a "thing," and puts him where he is ... most efficient." (9) Paul C. Violas, after sustained study on the training of the urban working class, reached the conclusion that "schools actually sought to develop what was called "industrial intelligence," - a sense of reality or a consciousness that led children to envision themselves as industrial workers." (10) Sol Cohen came to a somewhat similar criticism of the movement culminating in the
passage of the Smith-Hughes Act. He felt that movement, which he identified as the industrial education movement, "left another legacy, not so beneficent - the widespread conviction among American schoolmen that in a system of mass education, the academic side of school work was inappropriate for a majority of the nation's children."(11)

These critics generally overlooked the role of engineers and especially engineering educators in the vocational movement, a factor which provided grounds for review of their positions. This role took shape following the establishment of several national engineering societies in the 1870s and 1880s. These organizations sought to gain for engineers the same professional respect awarded to doctors and lawyers, and as one element of their professional concerns, stressed the social responsibility encumbent on all engineers.(12)

The notion of civil responsibility led engineers into a variety of social services, including the field of public education. Some engineers felt it their duty to actively promote technical education at all levels, not just in engineering colleges. The men holding such an interpretation of an engineer's social responsibility took on direct involvement with early vocational education and
through this relationship into the preparation of teachers to instruct in manual training schools, trade schools, and other technical and vocational schools. In these efforts, many engineers attempted to build a system of technical education which maintained many points of connection between elementary vocational training and the advanced engineering work at the land-grant institutions. Many of these educators considered their efforts an embodiment of democratic ideals, designed to strengthen the ties of workers and working class youths with academic schooling. While these "educationally conscious" engineers did not come to dominate or control the vocational education movement in America, they left a significant mark on the early efforts of several land-grant institutions to provide technical education for non-engineers, as well as engineers. In many ways, their programs provided a glimpse at an alternative structuring for technical education.

The purpose of this dissertation was to investigate the efforts of engineers at Iowa State University to promote and establish industrial education in Iowa. Chapter one focused on the period between 1870 and 1890, during which several professors of mechanical engineering included opportunities for students not seeking a college degree. Such efforts occurred not only in Ames, but at
several state colleges and land-grant institutions. After 1890, such training disappeared in Ames as the students of mechanical engineering devoted increasing time to engineering theory.

Chapter two treated the years from 1890 to 1910, when technical education for non-engineers, frequently called industrial education, became a vital concern of several associations of engineers and engineering educators. The intertwining of engineering education and early vocational education occurred on the national level through various organizations of teachers and/or engineers, such as the Society for the Promotion of Engineering Education, the American Association of Agricultural Colleges and Experiment Stations, the American Society of Mechanical Engineers, and the National Society for the Promotion of Industrial Education.

Chapter three traced the development of industrial education at the University of Wisconsin in Madison. In 1901, John B. Johnson, Dean of the College of Engineering, established a School for Artisans at the University of Wisconsin. That school started the direct vocational involvement of the engineers. This effort grew into an extensive engineering extension department between 1906 and
1910 under the direction of a powerful leader, Louis E. Reber.

Chapter four explored the promotional work in Iowa that culminated in funding for an engineering extension department at Iowa State College. Its leaders, some transplanted from Madison, duplicated the approach established in Wisconsin. In 1913, they established the Engineering Extension Department, which included among its earliest efforts limited work in the preparation of manual training teachers.

Chapters five and six traced the activities of the extension engineers prior to World War I. During those years, they conducted a wide range of instructional programs, reaching thousands of industrial workers and youths desiring industrial employment.

Chapter seven treated the impact of the war and the Smith-Hughes Act on the extension activities. After the passage of the Smith-Hughes Act, the courses for industrial workers, which stood as the primary activity of the extension department, fell under the jurisdiction of the Iowa State Board for Vocational Education. The teacher training program split off from the extension department,
becoming the department of Trades and Industries, and later the Industrial Arts department. By about 1925, the Trades and Industries department, which earlier had involved various vocational programs, centered all its efforts on teacher training. This mission dominated the department through its various name changes until recent years.

Since the preparation of teachers has now become a minor aspect of the department's work, the ideas and alternatives tried by the engineering educators before the teaching mission became dominant can provide needed background for current decisions about the desired future of industrial education at Iowa State University. In addition, the story of the development and activities of engineering extension in Iowa provides an needed rebuttal to some of the harsh criticism aimed at American vocational and technical education.
FOOTNOTES


6. For references to these works, see the bibliographical note in Lazerson and Grubb, pp. 51-56.


9. Ibid., p. 362


For background on the term "industrial intelligence," see Kenneth C. Gray, "Support for Industrial Education by
the National Association of Manufacturers: 1895-1917."


12. Two of the primary works on the professionalism of engineers and the conflicts surrounding this change are: Monte A. Calvert, The Mechanical Engineer in America, 1830-1910; Professional Cultures in Conflict (Baltimore: Johns Hopkins Press, 1967) and Edwin T. Layton, Jr., The Revolt of the Engineers; Social Responsibility and the American Engineering Profession (Cleveland: Press of Case Western Reserve University, 1971).
CHAPTER 1:
MECHANIC ARTS IN AMES

In 1862, when Justin Morrill used the term "mechanic arts," it referred to a number of occupations related to industry. An indication of this breadth of meaning occurred in the title of the Journal of the Franklin Institute. In 1857, that title placed mechanical and physical science, civil engineering, the arts of manufacture, and the recording of inventions as elements of the mechanic arts. Senator Morrill did not take exception with this definition. He also gave it generic meaning when he wrote, "Civil engineering in the agricultural colleges is perhaps one of the most useful branches of the mechanic arts ...." In accordance with this understanding, the A&M colleges delivered such training as fit students for a variety of industrial vocations and professions.
However, by about 1900, Morrill's intentions no longer characterized the mechanical branch of most A&M schools. By that time, mechanic arts had separated into manual training, trade training, industrial and vocational education, and several fields of engineering. Of those offspring of mechanic arts, only engineering remained solely in the colleges. The other segments had entered the public schools, private and public trade schools, or had temporarily disappeared.

That shift led educators to redefine the term "mechanic arts." In 1893, Christopher W. Hall, the Dean of the College of Engineering at the University of Minnesota wrote, "I have no hesitation in saying that the conception of mechanic arts in Senator Morrill's mind was that understood by us in the term manual training as this work is exemplified in the work of our best high schools."(4) He thus reduced the generic meaning to the single facet, manual training.

Robert H. Thurston, Director of Sibley College, Cornell University, provided in 1896 another slant on the difference between manual training and the mechanic arts. He identified the training as instruction in general use of tools, while mechanic arts referred to trade school
training in the specific use of those tools related to one industrial vocation. (5) Thus, he reduced mechanic arts to trade training.

While they disagreed about the new definition, they did agree a major shift had taken place. The mechanic arts no longer encompassed engineering but rather held a separate and lower position than engineering education. In their view, the industrial professions, the various branches of engineering, and the industrial vocations had separated.

At the time and later, some observers felt that shift depended on an increased application of scientific principles. In 1894, William S. Aldrich, then a Professor of Mechanical Engineering at the University of West Virginia, characterized the early years in many land-grant institutions. During that period, "instruction in the mechanic arts had not yet developed into a science...." (6) Consequently, those years held, for Aldrich, rather limited importance.

Almost 40 years later, the author of a federal survey of the land-grant institutions restated Aldrich's view. He wrote, "For a number of years, the institutions were mere
trade schools in agriculture and mechanic arts...."(7) He felt that scientific research began during the 1880s and caused a major change in instruction. During that period, the "secondary trade schools in mechanic and industrial arts were transformed into engineering colleges."(8)

The argument that scientific study separated engineering from the other mechanic arts oversimplifies the development. The ties between engineering and other mechanic arts were much closer and more complex than that model suggests. The earliest training of mechanics relied heavily on the development of manual skills. As the engineering schools grew, educators came to disagree sharply about the status of skill learning, usually called shop-work instruction. Some felt students needed as much skill development as many skilled craftsmen. Educators pursuing such a goal tended to create functional trade schools in the engineering shops. Others sought to reduce shop-work in order to devote more time to theoretical studies. They often saw extensive shop-work as a potential threat to high quality engineering education. Even after the introduction of the so-called scientific studies, concern for skill development in engineers and non-engineers did not dramatically diminish. However, engineers had to search for a new format, one protecting
the special status of engineers, yet one permitting extensive programs in skill development. Out of this search, the engineering extension movement grew.

A major influence on the partitioning of the mechanic arts into various facets came from several national engineering societies. They included the American Society of Civil Engineers, which began continuous activity in 1867, the American Institute of Mining Engineers starting in 1871, the American Society of Mechanical Engineers organized in 1880, and the American Institute of Electrical Engineers in 1884. These groups argued that engineering deserved recognition as a profession, on equal footing with medical or legal societies.

Although the process of dividing the mechanic arts differed from college to college, the battles invariably revolved around shop-work instruction. Thus, changes in the amount, methods and goals of shop-work revealed the shifting status of those arts. Such alternations at Iowa Agricultural College formed not only the background to later programs in engineering extension. They also reflected the influence of several nationally renowned schools, thereby linking Iowa to larger developments.
On the seventeenth of March, 1869, a crowd numbering well over one thousand gathered in Ames, Iowa for the formal inauguration of the Iowa Agricultural College. While many of Iowa's most prominent political and educational leaders attended, Iowan farmers comprised the vast majority of the audience. The feelings of these tillers of the soil found expression in the words of Benjamin F. Gue, President of the Board of Trustees, who identified the fledgling institution as the "People's College." These farmers expected the new college to provide a scientific and practical education to their sons and daughters, and during its first few decades, they repeatedly strove to control the direction of its growth.

Notable by their absence in both the name of the college and as a significant force at the inauguration were the practitioners of the mechanic arts. This absence reflected the minor role industrial production played in Iowa at the time. One estimate placed the total number of factory employees at 25,000 in 1870, a scant two in every one hundred inhabitants. However small this number, these mechanics laid claim to a share of the new institution. They too saw the new college as a "People's College," one to train students in the mechanic arts and to serve the needs of industry. Recognition of their claim to
the college did not appear in its title for several decades, for not until 1886 did the catalog begin to use the name, Iowa State College of Agriculture and Mechanic Arts, and not until 1897, did the Board of Trustees officially adopt that designation. (11) Though lacking such recognition, training in the mechanic arts, which started within a few years of the inauguration, began to prepare students for several rather undifferentiated industrial occupations.

When Iowa Agricultural College officially opened, students could elect to pursue either agriculture or mechanic arts. Because the course work was identical for the first year and a half, the administrators were able to begin school without a full staff. This was the case with the mechanic arts instruction, for not until the beginning of the third year did the college hire an instructor specifically for that work. At that time, the school year, still determined by the opening of the college, began in March and ended in December. Consequently, the new professor, William B. Anthony, arrived in Ames sometime prior to March 1871. (12)

Anthony's qualifications included an engineering degree from Yale. He had also accumulated some experience
teaching at Antioch College, Yellow Springs, Ohio. He left Ohio to take a position as Professor of Physics and Mechanics, for which he received $2000 per year. Of the ten employees for that year, only two received a higher salary which indicated his relatively high status in the faculty.

During the 1871 year, Anthony's teaching load in mechanics amounted to two classes per term, chiefly instructing students in the junior class in mechanics, mechanical drawing, and free hand drawing. In addition to this formal course work, he also took charge of the assignments of manual labor. Such manual labor regulations provided one of the guideposts, indicating changes in the notion of mechanic arts.

All students fulfilled a requirement to perform manual labor by working 2 1/2 hours per day. As early as 1871, such labor had split into two levels, an non-instructive type for which students received an hourly wage of three to nine cents, and instructive work, which earned no monetary compensation. The plan to require such labor developed in 1864, as part of an efforts to define the objectives of Iowa's incipient land-grant institution. College officials claimed manual labor as an essential part of a college
education. Rather than associating labor with "the idea of poverty and want," these men hoped under their new scheme to link the idea "of laziness and worthlessness" with "those who refuse to work efficiently...."(16) This approach also functioned as a method of evaluating the students, for "no young man, of whom there is any hope for future usefulness in life, is insensible to the disgrace which thus attaches to the lazy...."(17) In addition to its value in moral measurement, the required labor had a democratizing purpose. It was to place all the students on an equal footing, "that there may be no distinction between the sons of rich or poor...."(18)

According to these plans, all students labored in one of five locations: the garden; the nursery; the boarding hall; the farm; or the workshop. The students of mechanic arts went into the workshop, a two story wood-frame building, 30 by 50 feet. It included an attached engine house and brick smoke stack, all for an original cost of $5000.(19) Construction may have been finished as early as the first of October 1870, and certainly before the start of the 1871 school year. This shop contained a 15 horse power Corliss steam engine, apparently a high quality machine, for it worked "with the most prefect regularity," and required no repairs during its first year of
operation.\(^{(20)}\) The shop also sported tools for metal and wood working and two lathes built at the machine shop of the Worcester Free Institute in Worcester, Massachusetts.\(^{(21)}\)

This reference to the Worcester Institute marked the first in a long series of impacts it had on mechanics instruction in Ames. It influenced the goals and philosophy as well as the department's equipment. These effects, in turn, stemmed from the basic approach selected by the Institute at its establishment.

The Worcester County Free Institute of Industrial Science opened in the Fall 1868 with Charles O. Thompson as president. Thompson, who had traveled in Russia for the purpose of examining their system for technical education, "advocated from the first the idea of the manufacture of useful things..."\(^{(22)}\) Consequently, the Institute opened large and well equipped shops to facilitate manufacturing. These shops operated on a commercial basis, producing finished goods for sale in the marketplace.

The first superintendent of these shops, Milton P. Higgins, boasted that "A large amount and a great variety of machinery is designed, constructed, sold and operated,
in competition with all the best builders of machinery."(23) The lathes in Anthony's workshop evidenced the speed with which this system achieved commercial production. Such emphasis on making and selling machinery grew out of the high status awarded the shop-work instruction.

Higgins described the relative status of the shop-work at the Worcester Institute as "coordinate" in importance with the academic work...."(24) This view coincided with expectations for the abilities of Institute Graduates. Such men were to be capable of performing most of the tasks done by skilled tradesmen, yet understand design and scientific principles. A few years later, this notion also led Higgins to criticize those schools which placed shop-work as subordinate to training in engineering theory. The schools which down-played shop-work tended to produce "scientists and not mechanics," who, according to Higgins, were not engineers but rather "scientists in engineering."(25)

Anthony stated in his "Report of the Department of Physics and Mechanics," that the objective of the workshop was "to furnish instructive labor for the students in mechanics arts."(26) To help determine the role of such
shop-work in his program, he had investigated both the Worcester Institute and Illinois Industrial University (later the University of Illinois). He knew dollar amounts appropriated for shops in both schools, and in the case of the Worcester Institute, knew about the commercial orientation of their efforts.(27)

While he envied the monies spent on the shops at Worcester, he did not wish to emulate the commercial emphasis. He criticized that approach, indicating that the attempt to run a shop as a business was on the one hand very expensive, and on the other, financially precarious, since the students possessed moderate skills. In addition, allowing the marketplace to select the items for production might not provide the instructional experiences needed by the students. By avoiding the costs, risk, and instructional constraints of commercial work, Anthony hoped to provide for his students "the best kind of work."(28) He clearly defined his goal, claiming that "the business of the shop be the manufacture of mechanical models and such pieces of apparatus as can be made here."(29)

For Anthony, the best kind of work did not lead to the highest development of skills. Although he did not directly state that shop-work held a subordinate position,
that view informed his comments about skill development. He felt that the labor could "go far towards" making the students skilled workmen, and that they should "acquire a fair proficiency in the use of tools." However, the key lay in the range of experiences. (30) He asserted that "the work must present as great a variety as possible," since only diverse activities could "make the student acquainted with the resources at his command...." (31)

His approach to shopwork placed Anthony in company with few other educators who were searching for a system by which to organize skill training. Notable among these men was Calvin M. Woodward at Washington University in St. Louis and John D. Runkle of MIT. In 1871, a catalog of Washington University announced that there "will be fitted up a workshop containing an elegant lathe...," on which engineering students were to gain some skills. (32) During the 1872 year, Woodward increased the equipment in this shop dramatically and began to develop a systematic approach to shopwork instruction. He continued to experiment with methods of instruction for the shop between 1873 and 1876, but did not fix upon a series of graded exercises. A breakthrough came when he visited the Centennial Exposition in Philadelphia and examined the exhibit of the Russian system for tool instruction.
Woodward proclaimed, "To Russia belongs the honor of having solved the problem of tool instruction." He claimed that under the Russian approach "manual tool instruction has become a science...." (33)

John D. Runkle had a similar experience at the Exposition. In comments on the Russian exhibit, he revealed his previous confusion about the role of shopwork. He wrote, "I saw at once that they [the models] were not parts of machines, but simply graded models for teaching the manipulations in those arts. In an instant, the problem I had been seeking to solve was clear to my mind; a plain distinction between a mechanic art and its application in some special trade became apparent." (34)

Both Woodward and Runkle received acclamation as founders of the Russian system in America. In a story known to all industrial educators, Woodward first used the Russian method to train young engineers in St. Louis, and later located that work in the Manual Training School of Washington University. That school served as a model for a number of manual training schools that sprang up around the nation in the 1880s and 1890s.

Runkle also won a secure position in the history of
industrial and vocational education by bringing the Russian system into MIT. Under his direction, MIT established the School of Mechanic Arts, which involved engineering students in graded exercises. That school also served as a prototype for schoolmen wishing to institute industrial education.

Anthony won little recognition for his ideas on shopwork instruction. Though his plans did not amount to a systematic or formal use of graded models as a method for skill training, they placed him well before Runkle's interest, at least on a par with Woodward's efforts, and perhaps as one of the earliest American attempts to place models as central in skill training. He asserted that his plan "will furnish a great variety of the best work, will require no great outlay for material...."(35)

To achieve this high quality instruction, he requested $10,000 to purchase more tools and equipment, and to employ two "first-class" workmen, experts one in metalwork and one in woodwork. While the committee which received his report commended his plans, it allotted only $2500, and that to come out of the interest fund of the department of Physics and Mechanics.(36) Anthony's hopes thus received little financial support, and since he left Iowa in 1872, his
perhaps pioneering plans for shop instruction never developed fully. (37)

While Anthony's assignment included both physics and mechanic arts, his successor, Alexander Thompson received an appointment as professor of mechanical engineering and superintendent of the workshop. Besides identifying Thompson as Professor of Mechanical Engineering, the title of the curriculum also changed from mechanic arts to mechanical engineering. (38) Although the title changed in 1875, it represented only a semantic difference, not a difference in the instructional activities. Thompson, who held the degree of civil engineer, received a salary of $1600. (39) This was considerably less than Anthony's and apparently Thompson also held somewhat lower esteem in the eyes of the school administration.

A.S. Welch, President of the college, complained in his report of 1875 that the tasks performed by students in fulfillment of their labor requirement bore little relation to their educational needs. He instructed the professors in agriculture, horticulture and mechanics to make the labor "in the highest degree instructive," and to give equal care to both the manual and the intellectual exercises of the students. (40) While this reprimand did
not specifically name Thompson as lacking in instructional ability, his reports on the department of mechanics over his years in Ames indicate that under his command the shopwork instruction had little clarity of purpose.

This rather confused situation also characterized a number of schools during the 1870s. A source for information on the differing goals of shop-work appeared in the Industrial Section of the National Education Association. That section, which formed in 1875, drew professors of both engineering and agriculture, for each claimed a stake in manual training.

In 1876, Professor Manley Miles, an agriculturalist from the Illinois Industrial University, contributed a paper, "Instruction in Manual Arts in Connection with Scientific Studies." He cited the problem, writing "The great dangers that beset our industrial colleges and threaten to divert them from their legitimate sphere of usefulness - arise to a great extent from the confused notions that exist in regard to a liberal education in connection with an industrial art."(41) He went on to claim that any institution that taught trades as a leading object had sunk "to the level of mere training-schools in the arts."(42) In his view, time spent developing manual
skills needed to be carefully restricted.

In 1877, another agriculturalist, Professor George T. Fairchild of Michigan State Agricultural College, presented a paper, "Systematic Manual Labor in Industrial Education."(43) In contrast to Miles, he felt the state colleges should accept the task of preparing the educated laborers. To produce such men, manual activities should "conform as nearly as possible to the character of genuine work...."(44) To guarantee that connection, he recommended that the products of shop-work instruction should enter the marketplace. Similar ideas also appeared in a paper by Charles O. Thompson of the Worcester Institute.(45)

At the same meeting of the Industrial Section, John D. Runkle praised the Russian system he had just instituted at MIT. In contrast to Fairchild and Thompson, he argued against the production of salable articles "because such are not the best to make for educational purposes."(46) Though still in an embryonic stage, Runkle's plan tended to subordinate shop-work to theory.

In Ames, Professor Thompson vacillated between extensive commercial production and the making of instructional models. By 1875, he brought some commercial
emphasis into the skill training. The shopwork, called practical instruction, consisted of projects, in which students produced "some machine of new design, or one which shall be of practical utility to the College or to those who may avail themselves of our advantages for manufacturing."(47) This addition of contracting for the general public placed pressure on the shops to function to some extent as a business.

However, Thompson did not fully take up the approach of the Worcester Institute, for exercises remained a part of the training. After the Centennial Exposition, Thompson, like Runkle, jumped on the Russian bandwagon. He declared that the machine shop operated under a plan "similar to that adopted by the Russian government."(48) He also reported that students executed a series of exercises in the use of hand tools, and after considerable practice in this style, they advanced to work on power machinery.

However, he never took the Russian system to its logical extreme, but maintained some half-hearted commercial attempts. During the 1877 school year, he repeatedly ran an advertisement in The Aurora, a monthly literary publication of the college. This ad proclaimed
that the workshops would manufacture steam engines that
were "as economical as any in the market."(49) As
additional offerings, the workshops stood ready to do
scroll-sawing, wood-turning, and all kinds of molding.(50)
Under Thompson, shopwork instruction included influences of
both the commercial and the Russian approaches. The
college catalog characterized workshop practice as of "a
general character; it is not pursued with a view to any
particular trade or calling."(51)

Although Thompson vascillated about the goals and
direction of shop-work instruction, he worked steadily to
increase the productive capabilities of the shop. Until
1874, both the equipment and the instruction in
metalworking and woodworking resided in the workshop
building. In 1874, a physics building was completed, and
the metalworking machinery moved to the basement of that
structure. A wire rope transmission brought power from the
steam engine in the workshop to the line shafting, which in
turn drove the machines, two power lathes, one hand lathe,
one planer, and one drill press.(52) Removal of the
metalwork created space in the workshop, which then took on
a new organization, with the heavy machines on the ground
floor and benches and hand tools on the second floor. The
power machines, consisting of lathes and saws, had their
own system of line shafting, similar to that in the machine shop. (53)

Thompson's shops, even though they contained a modest supply of equipment and produced items of small commercial value, appeared to local industrial workers or those seeking industrial work as a potential source of specific skill training. By 1877, Thompson had received sufficient requests that he felt impelled to initiate steps to educationally serve non-engineering students. He stated, "Arrangements are now made to admit those who do not wish to take a full course in Mechanical Engineering, but who desire to get the shop practice, or to follow some particular line of study for a shorter time." (54)

This training of non-engineers remained a minor portion of the curriculum. It served a small number of students beginning in 1877 and lasting at least till Thompson's retirement in 1884. During those years, that effort received no mention in the college catalog. However small, in this attempt Thompson provided instruction for individuals seeking not the industrial profession of engineering, but industrial vocations. His effort to distinguish the two categories and serve them both stood as one of the earliest, if not the first, such programs in
land-grant colleges.

Since the special students spent most of their time in the shops, their presence complicated the supervision of those facilities. That supervision had fallen on Thompson, but as enrollment increased and the shops grew in size, that task became too large for one professor of mechanics to handle, and in 1882, the college secured a foreman for the shops. (55) This foreman, Fremont Turner, graduated in 1879 from the mechanical engineering course at Ames, and received $1,000 per year for his duties as foreman and teacher. (56) Though the artisans contributed to the need for such a foreman, they also presented a dilemma.

Thompson found himself in a rather awkward position. On the one hand, he upheld the view that engineers deserved recognition as professionals. In 1881, Thompson asserted that the graduates of his department were prepared to design, invent and superintend, and were not "mere artisans." (57) On the other hand, he expressed pride in the attempts to also train non-engineers. Directly following his assertion of the superiority of engineers over artisans, he proclaimed the training of non-engineers as a major value of the mechanical department. "Another feature of the school is, that it is open to those who do
not wish to pursue the course of mechanical engineering, but who wish to take special studies and the practical training."(58) He indicated that several students had taken the non-engineering work, and touted the success of one young man who spent one and a half years at Ames and was "now engaged at mechanical work at $90 per month."(59) That wage compared favorably to the salary of a recent graduate of the four year course who earned $1,000 per year.(60)

To a large extent, the instruction for artisans depended personally on Professor Thompson. In the spring of 1884, he did not complete the term, but took a leave of absence, and traveled to Louisiana.(61) In his absence, Professor W.F. Cole from Worcester, Massachusetts took temporary charge.(62) When it became clear that Thompson would not return, college officials sought a permanent replacement, selecting Norman C. Bassett to head mechanical engineering. Like Cole, Bassett also had ties with the Worcester Institute. Since Bassett never mentioned the training work in his reports to the Board of Trustees, and since no word about it appeared in the college catalogue, that work likely disappeared at the time of Thompson's retirement. However small Thompson's effort was, it represented an attempt to establish vocational instruction
under the auspices of the engineering department.

Bassett moved to Ames in late Spring 1884 and stayed at the college only till May 1888. He received a salary of $1800 per year. That wage placed him near the top of the scale, for of the 19 full time staff members, two received higher wages, and four others the same amount. (63)

Under Bassett, the shop-work instruction changed radically. At that time, engineering educators discussed the role of shop-work almost exclusively in terms of the approaches exemplified by MIT and the Worcester Institute. (64) Some, including Bassett, viewed the two systems as mutually incompatible. In accordance with that view, he rejected all traces of the Russian system, transforming the facilities into commercial job shops. He blasted the use of graded exercises since the pieces so produced had no practical utility, and other than use as exhibition pieces, and were most frequently "thrown into the scrap pile soon after completion." (65) This waste of time and materials was intolerable.
In contrast, under Bassett's direction, the shops geared up for production. During the 1885 school year, the output included 28 drawing desks, 8 work-benches, 8 machinists vices, numerous tool cases, tools and machine parts. His long range plan included the manufacture of "all tools, machinery and apparatus," needed by the department, aside from speciality items beyond the capabilities of a general shop. After meeting the "in-house" needs he intended to produce machinery for sale and to conduct the shops "as a manufacturing establishment." In preparation for this role, he worked to reestablish the ties Thompson tried to begin with local businesses, doing some special woodworking for local contractors and builders in 1885.

Bassett felt his commercial orientation not only increased the practicality of the shop work but also heightened the interest of the students in careful, efficient work habits. He cited student requests for additional shop work as support. To support this claim about the motivational value of production for sale or use, Bassett cited student requests for additional shop work. In 1887, the entire freshman class "voted unanimously to have shop work on Saturday in order that they might have a full, uninterrupted day." In Bassett's view, the only
obstacle to even higher participation involved a lack of equipment in the shops.

Before Thompson retired, he complained about the basement quarters for the machine shop, describing it as "damp, poorly lighted, and unfit for the purpose."(70) Adequate space for the shop became available in 1884 when the construction of the Engineering Hall reached completion. The machine shop moved into a wing of the Hall, providing "all needed space for class-rooms and machine-shops."(71) The difficulty was that the machine shop had equipment to instruct only six to eight students. Due to this limitation, the students had to "wait their turn" to use the machines, and the subsequent discouragement led, according to Bassett, to a high dropout rate.(72) The freshman class of 1887 began with 26 students, and by the end of the year dropped to 16 students.(73) Bassett's solution was to eliminate the discouragement by providing more work-stations, and he requested $3,000 for that purpose.

Despite the limited numbers of machine tools, the students achieved sizable production for the years 1886-87. The items made included 10 carpenters benches, 40 desk stools, 18 instrument cases, 7,000 cleats for the Edison
Electric Light Company, 30 clamps, 220 turned posts, one office desk, one wash stand, one dressing case, 10 machinist's vices, 2 letter presses, one small steam engine, one speaker's stand and various tools and machine parts. (74) Bassett presented this list of products as an indication that the system, named by him as the "manufacturing system," possessed a vitality far surpassing the Russian system.

He criticized the Russian method, which in his view did "not produce anything useful." (75) The error in that method lay in a mistaken philosophy which emphasized academic, not practical training. A section in the college catalog, likely written by Bassett, characterized that method as "a theoretical view of mechanical learning." (76) For Bassett, successful mechanical learning was unthinkable without extensive production of salable items.

Though Bassett did not utilize Higgins' term "coordinate" to describe the position of shop-work, he did exemplify that view. He felt skill instruction should be so extensive as to permit the students to use it as the basis for immediate employment in manufacturing concerns. As Bassett wrote, "It is the policy of the mechanical department to give its students a training so practical and
thorough, both in shop work and drawing, that it shall enable them as machinist and draughtsmen to earn a living, to get a foothold, immediately on graduating from the College." (77) In other words, the shop-work instruction produced machinists and draftsmen, who should be able to utilize skills in design and supervision after they had entered industry.

Bassett's commercial influence emphasis departed with him when he resigned in May 1888. A. J. Weichardt, the foreman of the workshops, took over Bassett's work for the remainder of the spring term. Weichardt had replaced Fremont Turner and, according to the catalog for 1888, had earned a degree Bachelor of Science. He returned to his position as foreman as soon as the replacement for Bassett arrived, apparently never appearing to the college administrators as a potential leader of mechanical engineering. At the same time, E. C. Kimball, "a practical machinist and former student in the mechanical department" took over control of the workshop. (78) He had not graduated from Iowa Agricultural College, but managed to utilize use his training there as the basis of his vocation, both as machinist and teacher.

Weichardt and Kimball directed the program only a few
months. Charles W. Scribner, a graduate of the classical course at Princeton and of the mechanical engineering program at Stephens Polytechnic Institute, emerged as Bassett's permanent replacement. (79) He joined the staff for the fall term of 1888 at the same salary made by Bassett, but brought a totally different approach to shop instruction. (80) Even before accepting the position he indicated his views on the role of shopwork. In June 1888, he stated that "The training to be given a student would have to be first considered, so that exercises rather than manufacturing should form a large part of the work, especially at first." (81)

However, Scribner did not attempt to return to the pure Russian system. He felt that the manufacturing aspect held value for the advanced students, ones who had gained the benefits of initial work on graded exercises. The main value of manufacturing lay not in the financial returns from such work but in educational values, for when the results of their labor went up for sale, the students felt an "increased responsibility" for both the time, materials, and "proper finish" of the work. (82) Scribner instituted this plan, which amounted to a compromise between the Russian and Worcester systems, in 1888.
The same solution had been suggested in May 1886 by Robert H. Thurston, a nationally known leader in engineering education. During discussion at a meeting of the American Society of Mechanical Engineers in Chicago, Thurston advised that entering pupils needed to learn tool use, and that could "undoubtedly best be done by a series of graded exercises."(83) Once the elementary skills were completed, the students needed to feel their efforts "have a real and immediate practical outcome." Consequently, a combination of the two methods will "have a maximum value."(84)

This compromise instituted by Scribner did not lead to any reduction in shop facilities. On the contrary, those facilities expanded tremendously under Scribner. When he took charge, the carpenter and pattern shop, still housed in the old workshop then included 7 lathes in addition to the older equipment already listed.(85) In 1889, the machine shop moved into the entire lower floor of the Engineering Hall and included six engine lathes of varying sizes, one planer, one shaper, one cut-off machine, an emery tool grinder, one grinder, one buffer, one forge, and appropriate hand tools.(86) In the wing previously occupied by the machine shop, a new brass foundry took shape. It consisted of a melting furnace, molding benches,
and equipment to make both green sand and dried sand molds and cores. To keep order in these burgeoning shops, three assistants were hired, one machinist, one carpenter, and a blacksmith. Judging by their wages of $750, $600, and $300 respectively for 1892, they were not, as Turner and Weichardt had been, college trained men.(87)

Students spent about 10 hours per week for four years in "shop practice." Dividing this practice time in specific tasks with selected tools and machines fell to the professor or foreman in charge of the shops. Under the influence of the Russian system, the students got assignments to complete various exercises, yet this also provided considerable flexibility in scheduling. Scribner indicated that students rotated through the shops in a systematic manner, each one fulfilling all parts of the work, "though not necessarily in the same order."(88)

The compromise did mark a significant development. Requiring entering students to work on graded exercises removed some of the immediate vocational value of the shop-work instruction. Before they developed any skills in manufacturing, they had already completed several years of schooling. In addition to that change, Scribner also increased the mental work required in the shops.
In 1888, he instituted "an entirely new and most important line of instruction," the precise testing of material strengths and machine power. (89) Scribner's claim of newness did not correspond with several established practices. Testing machine power had been carried out starting in 1872, when the students and professor acquired equipment to take indicator diagrams on the steam engine, and also estimate the power consumption of various machine tools by use of a simple dynamometer. (90) However, Scribner did dramatically upgrade these activities and increased their precision with the purchase of new equipment.

He also brought in a new area of testing through the acquisition of a 50,000 pound tensile testing machine. That machine permitted ultimate tensile and compression tests on various materials, plus bending strength tests. In addition, students calculated the shear strengths of welds, rivets, or bolts and used the results to determine the modulus of elasticity on the materials tested. (91)

These testing activities involved students in skills not directly marketable in most small industries. Thus by 1890, the shop instruction had become more closely tied to
engineering, and less valuable as trade training. This format for shop work remained rather stable at Iowa State for several decades. When Scribner left in 1891, George W. Bissell took over as the chair of mechanical engineering. That same year, W. H. Meeker joined the staff as Assistant Professor of Mechanical Engineering. In 1893, Bissell indicated that Thurston's plan also observations exemplified his program. (92) Meeker replaced Bissell in 1906, but maintained a similar approach to shop-work. He provided leadership in mechanical engineering for several decades.

Summary

The earliest mechanic arts training in Iowa involved students in manual labor. This labor, frequently menial, gave way to instructional labor, which occurred in the workshops. Well before the acclaim awarded the Russian method, Professor Anthony began to utilize models as a central method in skill building. He awarded skill building a subordinate position. In contrast, Alexander Thompson placed high value on skills, although he vacillated about the method to achieve skills. He also began intentional efforts to train artisans who were not engineering
students. That placed him in a rather contradictory position, for he felt a need to distinguish engineers from "mere" artisans. Yet he also was proud of his vocational instruction. Bassett eliminated all traces of the Russian method and established the shops as a commercial business. In order for students to produce salable items, they needed to develop such skills that upon graduation they could take employment as machinists and draftsmen. Under Scribner, the Worcester approach no longer had full expression. Consequently, the skill level of the students dropped, for they spent less time on production. Instead, beginning students followed the Russian method, completing numerous exercises. In addition, they devoted increased time to tests on material strengths and properties. The combination of the Russian and Worcester approaches continued under Bissell and later Meeker.

Iowa State was not the only engineering school that had made some small efforts to train artisans only to later eliminate such offerings. That change characterized a number of engineering schools. In Wisconsin, students did not stop seeking vocational training at the university. Some students eligible for entrance to the University began the mechanical engineering course and then dropping out once they had gained desired shop skills. In 1896, an
engineering professor reported that to combat this practice, the University made it a rule to refuse admission to students "who come simply to learn shopwork." (94) In addition, it required all engineering students to carry three full studies as a prerequisite to the shopwork.

William T. Magruder, Professor of Mechanical Engineering at Ohio State University, reported similar requests in 1899. He wrote, "Every teaching engineer has been aware of this need [for the training of artisans] from the number of requests which he has had to decline of young men who desired to take special courses in shop work, drawing, etc." (95) Magruder went on to refer to earlier attempts to accommodate those students. He mentioned the "general practice of our engineering colleges," to previously admit young men who had only a grammar-school education to selected college courses. After taking some of the academic work plus drawing and shop work, they "have left after a year so spent, the better prepared for their life's work." (96) In this training, the mechanical engineers in Ohio conducted a program very similar to Thompson's training for non-engineers.

Though in Iowa, Wisconsin, and Ohio, and perhaps other states, the engineers had terminated such artisan training
in the engineering shops, industrial growth guaranteed unrelenting demands by industrial workers for specialized training. Even those engineers wishing to serve that demand lacked an adequate approach. They had no format which preserved the professional status of the engineers engaged in trade and vocational training. This problem vexed engineers for years before they developed the structure which became known as engineering extension. In the struggle to determine this format, engineers supportive of industrial education tried to win a place for their views in several national organizations.
FOOTNOTES


8. Ibid., p. 3.


11. Ross, A History of The Iowa State College of
Agriculture and Mechanic Arts, p. 212.


13. Ibid.


15. Ibid., p. 25.


17. Ibid.


21. Ibid.


26. William A. Anthony, Report of the Department of

27. Ibid., p. 129-130.

28. Ibid., p. 130.

29. Ibid.

30. Ibid., p. 129.


34. John D. Runkle quoted in *History of Manual and
Industrial Education, p. 320.


37. O. W. Peterson, "Department of Mechanical Engineering," Iowa Engineer 20(8) (May 1920):258. After Anthony left Iowa, he took a chair of physics at Cornell University in 1872.


41. Manley Miles, "Instruction in Manual Arts in Connection with Scientific Studies," Addresses and
Proceedings of the National Education Association 16, 1876, p. 254.

42. Ibid., p. 255.


44. Ibid., p. 227.


50. Ibid.


53. Ibid.


54. Ibid.


57. Thompson, Report of the Department of Mechanics,
Ninth Biennial Report, p. 31.

58. Ibid.

59. Ibid.

60. Ibid.


62. The Aurora 12(2) (April 1884):47.


64. For references to the development of the conflict between these two approaches see comments by John M. Ordway and Clarence A. Waldo in discussion on "Manual Training for Artisans," by C. M. Woodward, Proceedings SPEE 5 (1897):286-294. Though many schools combined the two methods, the Worcester Institute and MIT remained in sharp conflict for years. As late as 1903, this controversy appeared again when MIT replaced the word shop with the term laboratory. For details on that dispute, see Milton P. Higgins,
"Laboratory versus Shop," American Machinist 26 (20 August 1903):1200-1201. Higgins' article sparked a series of letters in American Machinist, which all appeared under the heading "Laboratory vs. Shop."


66. Ibid.

67. Ibid.
68. Ibid.


73. Ibid., p. 45.

74. Ibid., p. 46.

75. Ibid., p. 45.

76. Iowa State College Catalogue, 1885, p. 41.


78. Proceedings of the Board, Thirteenth Biennial
79. Ibid., p. 139.

80. Ibid.


82. Ibid.


84. Ibid.


86. Ibid.


93. For the development toward school culture and away from shop culture at Cornell University, see Monte A. Calvert, The Mechanical Engineer in America 1830-1910 (Baltimore: Johns Hopkins Press, 1967), p. 87-105.


96. Ibid.
CHAPTER 2:
SEARCHING FOR A RALLYING POINT

Between 1890 and 1910, engineering educators began to take several discernible positions on industrial education. One group held that their responsibility did not extend beyond efforts to guarantee a rigorous and thorough training of engineering students. Another cluster felt that a portion of the engineer's duty required involvement in all types of education related to the industries. Within this later group, two wings developed. One believed that all types of industrial education for individuals not seeking to become professional engineers belonged in the public and private secondary schools. The other wing felt engineers, particularly those in the land-grant schools, needed to directly provide training for non-professionals. Those men followed the lead of the University of Wisconsin, and around 1910 began to focus on engineering extension as the vehicle for such instruction. However, prior to that time, they struggled in several national organizations to
position engineers as leaders of industrial education. Within the AAACES, SPEE, and ASME they tried, rather unsuccessfully, to find an organizational home.

Engineers in the American Society for the Extension of University Teaching

One of the earliest attempts of engineering educators to develop industrial education beyond the confines of their shops occurred in the American Society for the Extension of University Teaching. Although the engineers played a rather minor role in that organization, which also had a short life, those attempts provided a model for other engineering educators.

That Society owed its existence to William B. Pepper. Pepper, Provost of the University of Pennsylvania, also physician and professor in the medical school, traveled in Europe and Britain to study the organization of education. In February, 1890, he gathered a number of Philadelphia educators to discuss extension work. They formed the nucleus of a group which worked to promote extension and on June 1, 1890, established the Philadelphia Society for the Extension of University Teaching, with Pepper as its President.
During its first season, it established 23 centers in the Philadelphia region, and delivered over 40 courses of lectures to almost 60,000 total attendance. The lectures drew a wide variety of people, from many occupations, including many women in the afternoon courses. Some evening courses were set up for workingmen. When requests for assistance to establish similar programs in other cities grew numerous, the leaders decided to set up a national organization. On December 23, 1890, the American Society for the Extension of University Teaching was established, with the Philadelphia Society as its first branch.

The organization published a monthly journal, "University Extension," and collected the first 12 issues in the Handbook of University Extension. It also set up an advisory committee which included Charles K. Adams, President of the University of Wisconsin, William R. Harper, President of Chicago University, Charles A. Schaeffer, President of the State University of Iowa, eight other university presidents, and other educators. The journal and advisory committee helped organize the rapid spread of extension courses.
These courses most frequently consisted of lectures on literature, economics and history. These lectures drew large crowds in some areas. As one example, in Wisconsin, the Assembly Chamber of the Legislature served to house the audience for lectures by Frederick Jackson Turner on American history.(5) Centers to coordinate this work sprang up in many states, and according to one estimate, by the end of 1890, more than 200 organizations delivered extension instruction in "nearly every state of the union...."(6)

To coordinate their efforts, supporters of this movement organized a national conference, starting December 29, 1891, in Philadelphia. From Pennsylvania, representatives of 11 colleges attended the conference. Most of the states east of the Mississippi sent representatives to the conference. Notables, such as William T. Harris, U.S. Commissioner of Education, and G. Stanley Hall, President of Clark University, also attended.(7) The conference drew attention to extension work and helped fire the spread of extension, which approached the status of a "craze."(8)

Lectures and presentations on engineering topics drew the interest of individual working men and of labor
organizations. By Fall 1891, extension workers in Detroit began to seek the support of the Trades' council for university extension. "It seems especially fitting that such organizations, which are so powerful, should join in a movement, which, if not intended especially for the working classes, is certainly calculated to accomplish for them great results."(9) The voice of labor also had representation at the national conference. P. J. McGuire of the American Federation of Labor delivered a speech, emphatically supporting the extension movement and the possibilities the American workingmen saw for it.(10) Just as some labor leaders joined the educators in the extension movement, some educators also went to the meetings of the labor organizations to promote the cause of extension among the working men. One such example occurred in Philadelphia at a conference of the Knights of Labor where Professor Simon L. Patten gave a talk on extension and "on the special advantages for workmen connected with the Extension study of Political Economy."(11)

A veritable hot-bed of industrial work occurred in Kansas. The University of Kansas did not follow the general trend of placing little emphasis on engineering topics, but instead made such material central in its extension efforts. Several courses started in Fall 1891.
As a part of these efforts, Professor Lucien I. Blake of University of Kansas delivered a series of 12 lectures on electricity and magnetism, using "apparatus for experiments furnished from the department of Electrical engineering of the University of Kansas."(12) The course attracted a wide spectrum of people, including 21 lawyers, 12 teachers, 12 students, 4 engineers and physicians, electricians, operators, clerks, and public officers.(13)

The work in Kansas earned college credit for the students. The University of Kansas offered certificates and diplomas to those completing nine lecture courses, each consisting of twelve lectures. For those students who already held a college degree, credits could be applied to a master's degree.(14) The University also accepted the extension work as undergraduate work, providing the hope of a college degree to those enrolled in extension courses. The diploma for nine twelve-lecture courses stood as equivalent to one full year in attendance at the University. (15)

Workingmen took advantage of these opportunities. In Topeka, the Trades and Labor Assembly helped organize the extension courses. As part of this work, a professor taught a course in Political Economy, "especially arranged
for intelligent workingmen," in both Topeka and Kansas City. (16)

The extension movement, which caught on so rapidly, also died out with equal speed. After the initial flurry of activity, many problems plagued the work. Locating and maintaining good teachers and lecturers was difficult for several reasons. In most cases, the teachers already held full time university jobs, and did extension work for little or no pay. This prompted one critic to remark that "a movement which places its reliance on the casual teaching of overworked men is condemned from the start." (17) In addition to this lack of adequate pay for the teachers, the work of an extension lecturer was demanding. Because of these factors, many universities abandoned the extension work by 1895. (18) Between the collapse of most extension work and its restart in 1906 in Wisconsin came a period described as "the fifteen lean years." (19)

Mechanic Arts in the AAACES

During those lean years, engineering educators supportive of extension type work also found lean results
in the Association of American Agricultural Colleges and Experiment Stations [AAACES]. That organization came into existance in 1887, founded by 35 teachers and administrators of state agricultural colleges and universities.(20) As witness the name selected, it paid little attention to the mechanic arts wing of the land-grant institutions. The list of delegates and visitors contained no professors of the mechanic arts till the 5th convention, when one professor of mining and metallurgy from Ohio first attended.(21) He marked the entrance of the engineers into the AAACES.

At the 6th convention, held in New Orleans, November 15-19, 1892, members of the section on college work reported the findings from a circular letter [a questionnaire] sent to gather reliable information about the instructional programs of the member institutions. Although not all responding schools differentiated between enrollments in agriculture and the mechanic arts, in those cases when the enrollments were separated, the section reported that "the tendency toward the mechanical course is very marked..."(22)

Most members of the Association viewed this development as a potential threat to the agricultural
wing. (23) However, some wanted the engineers to take a position of equal importance to agriculture. Supporters of that notion included men in prominent positions in land-grant institutions.

Charles W. Dabney, President of the University of Tennessee and James K. Patterson, President of Kentucky State College led a move to create a section on mechanic arts. They both referred to the organic act, arguing that the mechanic arts activities were placed on equal footing with agriculture. Dabney said that the name of the Association was "a misnomer, and our constitution one-sided. At the best, this constitution fails to represent properly two-thirds of our institutions." (24) He wanted the proposed section on mechanic arts to include civil and mining engineering as well as mechanical engineering. Dabney also proposed that the name become The Association of Agricultural and Mechanical Colleges and Experiment Stations. Supporters of this change felt this title was more in keeping with the intention of the Morrill Act. They believed that the Association was too narrowly defined, and consequently was missing a golden opportunity to grow in prestige. Dabney said, "...we have been working with hardly one-half of the interests involved represented, and I sincerely believe that the time is coming when we
shall make this Association influential throughout the country."(25)

Opposition to this change came from several members, including Henry E. Alvord of Massachusetts Agricultural College, who was at the time the chair of the executive committee of the Association. He said that the engineering professors had gotten "repeated invitations" to join the Association, but that instead they had "endeavored to start an organization in a measure rival to this one." Alvord indicated provisions to create additional sections and asserted that "if professors of mechanic arts come here and ask" a new section could be started.(26)

In this case, as on many subsequent occasions, the AAACES took the course of giving an insignificant concession to the engineers, yet refusing to rename the organization or redirect its emphasis. The motion to create the mechanic arts section passed, while the proposed name change went down to defeat, 37 to 23.(27) Christopher W. Hall, Dean of the College of Engineering, Metallurgy, and Mechanic Arts of the University of Minnesota was elected chairman of the mechanic arts section, with F. Paul Anderson, Professor of Mechanical Engineering from Kentucky as secretary. Apparently, President Patterson had expected
the success of a move to create the mechanic arts section, for Anderson was on hand to take up a position in this new work, although he was not listed as a delegate or visitor.

Alvord's comments on a rival organization of engineers likely referred to the Mechanical Engineering Teachers' Association. That organization began to take form in June, 1891, when twenty five professors of mechanical engineering met at Ohio State University in the hope of starting a society specifically for engineering professors in land-grant institutions. Both C. W. Scribner and A. J. Weichardt attended the meeting, Weichardt serving as secretary for the loosely formed group. That group met again one year later, taking the name the Mechanical Engineering Teachers' Association.

The role of shop-work received primary attention and immediately divided those in attendance. S. W. Robinson from Ohio State asserted, "We have no use for "shop work" in a school graduating men as mechanical engineers." His views received description as "differing radically" from other professors. They, on the other hand, supported a tendency "to get more and more of shop into the course."
This organization might have occasioned a unique response of the land-grant colleges to the growing need for technical training, but it disappeared upon the founding of the Society for the Promotion of Engineering Education in 1893. The SPEE, however, drew members from all engineering schools, not just those founded by the Morrill Act. Consequently, it did not provide a forum devoted to the mission of those colleges.

The World's Engineering Congress met in Chicago, starting July 31, 1893. It included a division named Section E, devoted to engineering education. During the meetings of Section E, Robinson spoke about the association of mechanical engineering teachers. He also called a meeting for those desiring to organize engineering teachers. At that meeting, the SPEE was born. In the minutes for the last day of the Congress, appeared a reference to "the organization of an Association of Engineering Teachers."(33).

The SPEE took as its goal the "shaping of the technical education of a nation," and invited "practically all the Professors of Engineering in this country" to join.(34) It succeeded well in drawing the engineering educators, listing 156 members in 1894. By 1896, it grew
to over 200 members and had already established itself as a powerful national organization.

Three months after the founding of SPEE, the new mechanic arts section came together for the first time at the seventh annual AAACES convention. The new section faced a multitude of problems, including the relationship between agriculture and mechanic arts, an appropriate definition for the engineer, curriculum stability in engineering schools, appropriate qualifications for educators, and the role of industrial education. The section elected John W. Washburn of Rhode Island as chair, and kept Paul Anderson as secretary.

The section heard papers by George W. Bissell of Iowa Agricultural College, C. W. Hall, J. J. Flather of Purdue, C. Russ Richards of Nebraska, and H. E. Smith of Minnesota. Bissell presented a paper "Shopwork Instruction at the Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa." His purpose centered on "provoking discussion" among the leaders of "shopwork instruction in the land-grant colleges."(35) He did not mention the training of non-engineers, but Hall broached the subject in a discussion of the rapidly changing definition of the engineer. He felt that the colleges should focus on the
preparation of professional engineers, leaving the manual training to the public schools. (36) Richards held a similar view, but drew attention to the need for expanding manual training. His paper "The Manual Training and the Apprentice System" treated the need for trade schools, which should go further than manual training in specific vocational education. He proposed trade schools organized by state governments, yet maintained as separate from the colleges and universities. (37)

While the section struggled to formulate its mission, it never secured a stable position in the association. Its status remained precarious, eliciting conciliatory comments aimed at the agriculturalist leaders, and complaints about their limiting decisions. In his paper, "Some Relations of Mechanic Arts to Agriculture," Hall attempted to show "concisely how intimate the agricultural and mechanic arts were and how they could assist each other in individual development." (38) This conciliatory tone degenerated into almost fawning by 1895, when the mechanic arts section advised that "our range of work in this Association should be a limited one," namely to function as "a valuable adjunct" to the agricultural educators. (39)

A portion of the willingness to claim such a minor
role involved the growing power of SPEE. Most of the members of the mechanic arts section also held membership in SPEE. The authors of the five papers presented in 1893 all joined SPEE by 1889. In contrast to SPEE, which grew rapidly in its first few years, the mechanic arts section drew few new members. In 1894, the section appointed a committee to encourage "all American colleges to send representatives" to the section's meetings, since only five new names appeared in its reports, four of whom were also members of SPEE.(40) While some members of the section tried appeasement, others expressed resentment.

At the ninth convention, in 1895, the conflict came to a head. The mechanic arts section recommended that AAACES take the initiative in establishing ties with SPEE and openly voiced its frustration. "Most of our men interested in mechanic arts are indifferent toward doing work for the Association, claiming that the Association is essentially agricultural and it is the intention of the agriculturists to keep it within such limits."(41)

This rather dramatic report should have sparked some discussion about the role of the mechanic arts within the Association, however, the next speaker took the opportunity to move that a small committee be formed to frame some
statements about Dr. N. S. Townsend, an instructor of agriculture at the State University of Ohio, who had recently died. The engineers couldn't get the Association to take them seriously, and in a section meeting the following day, they felt that treatment "brought out very forcibly that the Section on Mechanic Arts is not supported by the general Association, and in order to induce prominent educators in mechanical lines to take an active interest in the work of the section, some recognition must be given to mechanic arts in the name of the Association, inasmuch as agriculture is specifically recognized."(42)

Instead of withdrawing from the battle, the engineers brought their biggest contingent to the 10th annual meeting in Washington, November 10-12, 1896. The section had invited R. H. Thurston, who presented a paper entitled, "Education in Mechanical Engineering and the Mechanic Arts." The thrust of Thurston's paper was that both mechanic arts and manual training "come within the limits of operation of the engineering school...."(43) He indicated that manual training held no reference to any trade, but rather sought to develop the skills of a student. In contrast, a school of mechanic arts, which according to Thurston was synonymous with a trade school, aimed at the preparation of workmen trained for a
particular vocation. Within the confines of an engineering school, the workshops were to serve a different goal, namely "the instruction of the young engineer in the methods and practice of the arts subsidiary to engineering with the ultimate and main object of enabling him to design and to inspect intelligently." (44)

Thurston represented the view that shop-work held a subordinate place to academic work, and never desired the engineering educators to initiate trade training of non-engineers. However, he identified the need for trade schools as "the great unsupplied need of our country today." (45) Having identified this need, he did not draw the conclusion that the mechanic arts section could in any manner help alleviate the problem. Other engineering educators in AAACES had little opportunity to pursue the alternative conclusion, for the section decreased rapidly following the convention in 1896.

In a few subsequent years, the attendance in the mechanic arts section dropped off, and all motions to provide special recognition for the engineers failed. At the 12th annual convention, a proposal to change the constitution to include chemists, botanists, and engineers failed 44 to 8. (46) The 15th convention rejected a
proposal to include departments of mechanics arts as specially mentioned in the constitutional article on membership, and at the 17th convention, a proposal to create two large sections, one on college work and administration, and the other on experiment station work passed 53 to 1. That meant the disappearance of the section on mechanic arts, as well as sections on agriculture and chemistry, horticulture and botany, and on entomology. While the agricultural members of those abolished sections found corresponding locations in the new schema, the engineers had no representation in AAACES till 1915.

Industrial Education in the SPEE

Before the demise of the mechanic arts section, SPEE also took up discussion on the role of shop-work. In 1894, Christain W. Marx presented a paper, "Amount and Kind of Shop Work Required in a Mechanical Engineering Course." He claimed shop work as coordinate in importance to mental training and sided with those preferring the Russian system. The following year, Charles H. Benjamin, later Dean of Engineering at Purdue, contributed, "The True Place of Drawing and Shopwork in Engineering Colleges." He felt
those courses were essential in the preparation of engineers and tended to side with the commercial approach of the Worcester Institute. He believed it critical "to make the college shop a real shop where work is done as in outside establishements."(49)

Neither Marx or Benjamin felt engineering departments should make any move to extend shop-work instruction to artisans. Not till 1898 did any member of SPEE arise as proponent of training for non-engineers. Then John B. Johnson, Dean of the College of Engineering at the University of Wisconsin emerged as a powerful leader.

Before Johnson took the head position at Madison, he served as a professor of civil engineering for sixteen years at Washington University, St. Louis.(50) It was during his stay in Missouri that Woodward's manual training school won national recognition. The Manual Training School of St. Louis University under Woodward's leadership in no way attempted to prepare students for vocations in the industries. In 1888, Woodward indicated the direction of his school at a NEA convention. He asserted that "the
most popular choice of manual graduates is that of higher education," and that although the need for skilled workers had grown rapidly, "very few of the graduates of the manual training school become mechanics in the ordinary sense of that word." (51)

Although Johnson well understood Woodward's efforts, he chose a different tack. He had been elected President of SPEE in 1898 and used the traditional President's Address as an opportunity to express his concern about inadequate industrial education in America. After reviewing the rate of industrial development and the need for training, he cited the original act of Congress of 1862 which specified the education of the industrial classes. He criticized the engineering colleges because, in his view, they prepared men for "very narrow lines of professional employment," and also encouraged students to avoid occupations in the industries. (52) He also claimed the colleges and universities "educate men away from the industrial pursuits." (53)

Although he did not in so many words call on the land-grant schools to extend engineering education to include the training of non-engineers in industrial skills, he did cite a program conducted by Ohio State and the National
Brick Manufacturers' Association to establish a high grade industrial school. Johnson particularly favored those schools modeled after the German mono-technic schools and directly appealed to his fellow engineers, "should not this Society take the initiative in these movements? I believe it should, and I believe the future material prosperity of this country is very largely dependent on how these problems [of industrial education] are solved."(55)

In 1899, members of SPEE heard a paper presented by Onzi P. Hood, an engineering professor from Michigan College of Mines. He offered a solution difficult for many SPEE members to appreciate. At his school in Michigan, he had established an apprentice system in the college shops, similar to a program at Kansas State Agricultural College. After issuing a call for apprentices in the college newspaper, the supervisor for the apprentices selected 10 men, ranging in age from 19 to 20 years, many of whom had spent some time as college students. The presence of the apprentices in the machine shop provided several advantages. They did those tasks "that should not be expected of students."(57) They generally acquired higher skills than the engineering students, and thereby functioned as good examples for the students. Also, the apprentices finished up projects abandoned by the students.
Beside avoiding the temptation to "employ students on work of questionable instructive value," the effect of the apprentices led to an increase in the variety and amount of work done in the shop.(58)

Hood's paper stirred very little discussion, the only clear support coming from Clarence A. Waldo, a math professor at Washington University. He felt that Hood had located "a way by which an intermediate form of technical instruction might be given in our existing institutions without detriment to the institutions themselves, and to the great benefit of a large class of intelligent workmen...."(59) In spite of Waldo's support, Hood's apprentice program gained no support in SPEE, receiving in fact no further mention in the Proceedings.

The major fault with that plan lay in the extensive overlap between the education for the engineers and for the apprentice machinists. While the Worcester Institute employed skilled machinists in the shops, in Michigan the engineering professors had to directly participate in the simultaneous training of engineers and machinists. Even J. B. Johnson, one of the most ardent supporters of artisan training, felt the need to separate the student engineers from the artisans. The lack of this separation meant also
a lack of support for Hood's plans.

The same session of SPEE did respond to Johnson's plea by the formation of the Committee on Industrial Education. That committee drew some of the members most committed to the view that engineers had a responsibility to direct all levels of technical education. However, before it began serious work, the topic moved to the forefront in the American Society of Mechanical Engineers [ASME].

Industrial Education in the ASME

In December, 1899, Milton Higgins delivered a paper, "Education of Machinists, Foremen, and Mechanical Engineers" at the annual ASME meeting. This paper, which ran 38 pages in length, sparked a discussion so extensive it appeared in the Transactions as a separate pamphlet. One reason for the length of the discussion, 82 pages, was that copies of the paper had been circulated prior to the meeting, so those wishing to respond had time to prepare their comments.

The topic touched a nerve within ASME. An indication of its importance appeared in the response by Robert H. Thurston, for after reading Higgins' views, he distributed
it to various members of the teaching staff of Sibley College and gathered written statements from eight individuals ranging from the foreman of the blacksmith shop to the head of the Mechanic Arts Department. Together with Thurston's opinions, the total response covered 21 pages. Beside Thurston, 23 other members of the society delivered both favorable or critical comments.

The topic received attention in some journals which ran articles about Higgins' paper, in particular Railroad Gazzette, January 19, 1900. Higgins wrote an article in response which went into print both in Railroad Gazzette and American Machinist. Interest in the proposals made by Higgins did not diminish and led the leaders of ASME to arrange for Higgins to deliver a supplemental paper on the same topic at the following meeting of ASME in May, 1900. That paper, 21 pages in length, spurred another discussion, requiring 18 pages for the comments of 10 members.

Higgins proposed the creation of a half-time school, which should have as its objective "to produce many well-trained and educated machinists, and from these machinists some foremen, from the foremen a few superintendents, and finally an occasional engineer." Higgins planned for
the half-time school to utilize the approach found at the Worcester Institute, yet reject the tendency even of that institution to "drift more and more out of the reach of the boy who wished to educate himself as a mechanic...."(65)

As implied in his stated objectives, Higgins placed mechanics and engineers on the same continuum. He later made that connection explicit, asserting that the difference between the machinist and the engineer amounted to "a difference of degree and not of kind."(66)

This notion drew fire from Robert Thurston. In contrast to Higgins' implied continuum, he viewed training machinists, foremen and engineers as "radically different matters."(67) He characterized Higgins' plan as the intermixture of the trade school and the engineering school, an approach which in Thurston's view would weaken both types.(68)

By the time Higgins presented his supplement in 1900, he had clearly worked out his answer to Thurston's criticism. In that paper, Higgins provided an illustration of his educational philosophy. He described the Temple of Industry as a lofty building in which the lower floors contained the laborers and the upper levels the engineers. According to British practice, this temple contained no
stairways, ladders or other means of vertical transportation, and the engineers "always enter by a high trestle, which is very high and very straight."(69) Higgins claimed that Thurston represented this British view, thereby giving credence to the corresponding notion of horizontal stratification in society, "where each layer is well insulated from the others...."(70) In contrast his idea, one in agreement with American ideals, necessitated the preservation of numerous opportunities for individuals to move from the lower floors upward.

Higgins proposed a totally new type of school. His ideas influenced those educators within the land-grant institutions. Their interest in reviewing the direction of engineering education stemmed from the large numbers of people needing technical education. Arthur L. Williston, who strongly supported Higgins, expressed this relatively new situation. He wrote,

"It seems to me that to-day the problem confronts us of training young men, not as engineers, but, as Professor Higgins says, as foremen or overseers, men who can plan and direct work, not only in machine shops, but in all our shops, factories, and in all our industries. It is a hundred times more important to-day that this problem should be met than it was thirty-
five years ago that the problem of training engineers should be met as it was, because a hundred of the men that Professor Higgins describes are needed to-day to every one man of the other type."(71)

John B. Johnson also felt the need to respond to that state of affairs. He criticized the engineering schools for providing an education that carried young men "away from actual practice along industrial lines rather than into such practice."(72) Due to that tendency, few college graduates became "foremen, superintendents, and general managers" in manufacturing establishments.(73)

It is somewhat surprising that some members of ASME did not try to utilize the interest generated by Higgins to initiate some formal treatment of industrial education. However, ASME did not create any committee on education, not even on engineering education till 1915.(74) This situation drew the notice of Frederick W. Taylor in 1908, but at the time of Higgins' presentations, even his supporters did not mention the creation of any committee to support his efforts.(75)

The dominant view appeared in a comment by William Kent, who said, "I am afraid that all that the members of
this Society can do for Mr. Higgins is to give him our heartfelt sympathy and say, We are with you; go ahead."(76)

In order for Higgins to actually establish a school, considerable financial support had to appear, and Kent indicated that it should not come from public funds. "What is wanted is several millionaires with the idea that the thing for them to do with their money is to start such a school as Mr. Higgins wants...."(77)

The SPEE Committee on Industrial Education

in contrast to the majority of ASME members, John B. Johnson did set out to alter the practices of engineering colleges. His work centered on the SPEE Committee On Industrial Education, in which he held the position of chairman. That committee consisted of J. B. Johnson, Dean of the College of Engineering at the University of Wisconsin, Calvin M. Woodward, Dean of the School of Engineering and Architecture of Washington University, R. H. Thurston, Director of Sibley College of Cornell University, Henry T. Eddy, Dean of the Graduate School and Professor of Mathematics and Mechanics, University of Minnesota, George F. Swain, Professor of Civil Engineering at MIT, and Edgar Marburg, Professor of Civil Engineering at the University of Pennsylvania.
This committee, created in 1899, delivered a preliminary report in July, 1900, less than two months after Higgins presented his paper to ASME. It defined industrial education as "that education which specifically fits one for an industrial vocation or profession."(78) This definition, which placed both the industrial professions and the industrial vocations under the same umbrella, tended, as did Higgins' approach, to affiliate the engineers with the artisans. Claiming their view as truly democratic, the committee members asserted that "in America every boy should find his career entirely open at the top."(79) In words echoing Higgins' comments, they maintained that America, in distinction from a horizontally divided society, ought to have vertical tracks, with no impediments to the level of achievement of any citizen. The key to how far any person advanced lay with education. Only through an appropriate educational system could every boy or man "make the post of himself," and thereby bring the greatest returns to the entire society. In a rather pointed criticism of traditional American education, the committee reported "mental, abstract and memoriter education needs to be supplemented by a manual, industrial, industrial art, commercial, or engineering education if the boy is to become a doer, or a director."(80)
The work of this committee had vigorous support from many members of SPEE. Milton P. Higgins claimed that "no more important topic of education has ever been before the American people" than the training of mechanics and workers "below the grade of engineer...." (81) He felt that the A&M colleges and state universities had failed in their original purpose of training common industrial workers, and that the task at hand was to find a plan "to give this important force of mechanical workers an education...." (82) Higgins hoped the land-grant engineers would take a leadership position in creating a system of industrial education appropriate to the demands of industry and the educational needs of American workers.

In the discussion following this report the topic of university extension arose as a possible avenue by which the engineers could enter a new educational field. The first comment on extension in this context came from Frank C. Allen, Professor of Railroad Engineering at MIT, who suggested that Professor Johnson "look up the matter of university extension." Professor Allen thought that, although extension work had involved engineering in a very minor way, "there might be a chance for development in the direction of university extension...." (83)
This idea of utilizing extension activities as the vehicle for the presence of engineers in the industrial education movement was both new and in competition with other possibilities. An attractive alternative involved the support of SPEE for introducing industrial education into secondary schools. Arthur L. Williston presented this view in 1900, claiming that "the Society can do nothing that can be of more service to the community, to the profession of engineering, or for the welfare of the Society and its individual members, than by doing all in its power to promote the cause of the secondary technical education."(84) Williston wanted the Society to promote schools over which it would have little or no control. In so doing, he presented no long term role for engineers in the industrial education movement. This stood in marked contrast to the views of those engineers who fixed upon extension as their venue.

Johnson did not try to develop engineering extension in a formal manner, but did establish it informally in a program for training artisans under the auspices of the college of engineering at the University of Wisconsin. The school he started, to be discussed in the next chapter, signaled the start of systematic programs led by
engineering educators to extend their offerings to non-engineering students. Perhaps Johnson might have led the SPEE into a position of leadership in technical education for non-engineers, but his accidental death on June 23, 1902, at the age of 52 removed his influence from SPEE. With Johnson gone, the chairmanship of the committee on Industrial Education fell to Calvin M. Woodward.

In 1903, as then the President of SPEE, Woodward devoted his presidential address to "The Promotion of Engineering Education Through Improvements in the Secondary School." Woodward's position was that promoting the secondary school amounted to promoting engineering education. "In every instance manual training high schools look straight towards engineering schools, and the growth of the former leads inevitably to growth of the latter."(85) In support of this contention he mentioned that until 1902, his manual training school at Washington University served as the best feeder of engineering students, but that recently the public school had surpassed the training school in this area. He felt that the same change categorized manual training in other locations, citing that about 50 per cent of the graduates of the Chicago Manual Training School went on to higher education.(86)
While Johnson wanted the colleges to begin work in industrial education, Woodward considered manual training schools as an adequate, already functioning solution. Woodward's influence as chairman of the Committee on Industrial Education led away from Johnson's hopes for SPEE. The 1903 report of the committee consisted of three papers, one each by Woodward, Thurston, and Williston. Thurston's paper had nothing to do with industrial education and Woodward in his "The New Opportunity for the Secondary Schools," rehashed the successes of the manual training school in St. Louis. He presented no program or goals for SPEE, arguing that what America needed was lots of schools like his in St. Louis. (87)

Williston's presentation, "The Organization of Trade and Elementary Technical Schools," advised the creation of several types of schools, day trade schools, elementary day technical schools, evening trade schools, and evening technical schools. Like Woodward, he also focused on public secondary schools. His paper contained no concrete recommendations for action by the Society, and no mention of a role for engineers in any of the types of schools. (88)

Between 1903 and 1906, the Committee on Industrial
Education carried on little work. In 1906, Woodward prepared a report one paragraph in length which indicated that industrial education had grown in public importance. Although he remarked that there was "a very general discussion now going on in educational and industrial circles in regard to the establishment and operation of trade schools," he saw no role for SPEE, other than as observer, in these discussions. Woodward's view characterized the Committee on Industrial Education, and to some extent, the membership of SPEE, for as an organization, it never mounted any sustained effort to guarantee engineers a voice in the industrial education movement.

However, individual members in SPEE did not follow the majority lead. In particular, Dugald C. Jackson, the head of electrical engineering at the University of Wisconsin, maintained Johnson's position. Jackson served as the head of electrical engineering at the University of Wisconsin, starting his work there in 1891. Prior to accepting a position at MIT in 1907, he served as President of SPEE in 1905 and had worked closely with John B. Johnson before his death.

While Jackson did not hold membership in the Committee
on Industrial Education, he asserted that the land-grant institutions bore a responsibility to direct its development. In July, 1907, Jackson presented "The Relation of the Engineering Schools to Polytechnic Industrial Education." In that paper, Jackson argued that engineering schools covered a three part field, comprising engineering research and advanced engineering work, regular engineering work, and the instruction of artisans and industrial foremen.\(^{(90)}\) His paper dealt with the third category, which "comes distinctly within the purview of the influence and direction of the engineering schools though preferably not within the scope of their curriculums."\(^{(91)}\)

After a brief review of the status of industrial education, he characterized the secondary industrial schools as "utterly without adequacy in numbers or extent" and consequently unable to cope with wide-spread industrial training. Schools for the preparation of industrial foremen were "almost unknown...." Jackson singled out the culpability of the land-grant colleges for that state of affairs, saying, "I lay this latter fact at the door of the engineering schools, and hold that the members of the faculties are not guiltless unless they make adequate efforts to get filled this need in education for master craftsmanship in the industries, which comes within the
purview of their influence and direction."(92) As examples of moves in the right direction, he cited the Summer school for artisans at Madison, and the Lowell Institute School for Industrial Foremen. He concluded his presentation with a plea to the Society to join efforts to reduce the gap between college engineering programs and the elementary trades schools. "This gap must be filled and it will be filled promptly if the men who are and who ought to be members of this Society do their duty."(93)

Jackson's plea went unheard and SPEE remained an observer in the industrial education movement. While many engineers participated in efforts to promote industrial education at the secondary level, few tried to win a unique role for engineers in that movement. Even Milton Higgins exemplified that tendency, for though he had encouraged the training of foremen and supervisors by land-grant engineers, he came to focus his attentions on secondary schools. Higgins along with Charles R. Richards of Columbia University Teachers College and Magnus W. Alexander, the director of a training school operated by General Electric Corporation in Lynn, Massachusetts, initiated the actions that led to the formation of the National Society for the Promotion of Industrial Education in November, 1906, an organization instrumental in the
campaign which culminated in the Smith-Hughes Act of 1917. (94)

Higgins was not the only member of SPEE who joined the NSPIE. A comparison of the SPEE and NSPIE membership lists for 1908 revealed that 50 members of SPEE had also joined NSPIE. Several of them held prominent positions in NSPIE, such as William T. Magruder, Professor of Mechanical Engineering from Ohio State, who also served as secretary of the NSPIE state branch organization in Ohio. (95) Though these engineers represented a significant group in NSPIE, they never organized to promote a unique role for engineers in the organization.

At the same time as NSPIE gathered steam, the industrial education efforts in SPEE further declined. In 1907, the report of the Committee On Industrial Education mentioned the founding of NSPIE and other increased activities surrounding industrial education, but did not attempt to organize the power of the Society behind any plan of action. (96) Williston prepared the Committee report for 1908, which again proposed no involvement of the Society. The last report from the Committee represented only Woodward's views, for he did not consult with the other members.
Woodward, like Higgins, had joined NSPIE, apparently considering vocational education as a new mission for the high schools, one which engineers should support but not join. In October, 1911, he included in the last report a review of the importance of his work in establishing manual training in St. Louis, feeling that although it originated in the engineering school, it belonged under the control of the public secondary schools. Woodward wrote that "the special work which the committee was expected to do has been finished to the best of the committee's ability, and that there is no sufficient reason now for its continuance."(97)

This report marked the end of SPEE's involvement in industrial education. Although industrial education held a position of national prominence in 1911, the engineers in SPEE turned their attention scientific management and the beginnings of industrial engineering. The 1912 meeting of SPEE devoted one entire session to scientific management, featuring a presentation by Frank B. Gilbreth. With the demise of its committee on industrial education, SPEE drew even further away from involvement in the movement to establish engineering extension as the service mission for engineers in the growing field of industrial education.
Summary

The little group of engineering educators who wanted the land-grant colleges to directly enter the field of industrial education had precedents established by those engineering educators who participated in extension courses within the American Society for the Extension of University Teaching. However, they found no forum in AAACES, and after the demise of the mechanic arts section, work in ASME and SPEE offered a possible rallying point. The interest stirred up in ASME by Higgins in 1899 and 1900 did not result in action by that society, and though J. B. Johnson and D. C. Jackson fought for the idea, they did not sway SPEE to any organized efforts. Similarly, although many engineers worked in NSPIE, they did not create any special role for engineering educators in the industrial education movement. In spite of this lack of a national support group, a few engineers in Wisconsin continued to seek a format for educational service to workingmen and craftsmen.
FOOTNOTES


2. Ibid., p. 18.

3. Ibid., p. 19.


8. For the relationship of university extension to other educational experiments, including mechanics' institutes, lyceums, and the Chautaugua movement, see James Creese, *The Extension of University Teaching* (New York: George Grady Press, 1941), pp. 21-40.


10. Ibid., pp. 269-270.

11. Ibid.


15. Blackmar, "University Extension in the
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Southwest," Handbook of University Extension, p. 287.

16. Ibid., p. 289.


19. Ibid.


23. Ibid., p. 27.

24. Charles W. Dabney in discussion, Proceedings
AAACES, 6th convention, 1892, p. 76.

25. Ibid.


27. Proceedings AAACES, 6th convention, 1892, p. 76, 79.


30. S. W. Robinson, ibid.

31. Ibid.


33. Ibid., p. 12.


   Apparently Hall only presented one paper, although it received two differing titles, "Technical Education" on p. 67, and "Some Relations of Mechanic Arts to Agriculture" on p. 95.


40. "Minutes of the Section on Mechanic Arts,"
Proceedings AAACES, 8th convention, 1894, p. 89.


44. Ibid., p. 113.

45. Ibid., p. 115.


47. Proceedings AAACES, 15th convention, 1901, p. 50; 17th convention, 1903, p. 60. For further details on the status of the mechanic arts section, see W. O. Thompson,


53. Ibid.
54. Ibid., p. 34. For more details on the National Brick Manufacturers Association and the program at Ohio State, see Alexis Cope, *History of The Ohio State University*, vol. I (Columbus: Ohio State University Press, 1920), pp. 401-413.


57. Ibid., p. 65.

58. Ibid., p. 67.


65. Ibid., p. 653.


68. Ibid., p. 697.

70. Ibid.


73. Ibid.


75. Frederick W. Taylor in discussion, Transactions ASME 30 (1908): 632.

76. William Kent in discussion, Transactions ASME 21, no. 864 (1900): 1145.

77. Ibid.

78. "American Industrial Education: What Shall It Be?" Proceedings SPEE 8 (1900): 28. This report and extracts from SPEE discussion also published in Report of

79. Ibid., p. 29.

80. Ibid., p. 30.


82. Ibid., p. 64.


86. Ibid., p. 15.

88. Arthur L. Williston, "The Organization of Trade and Elementary Technical Schools," Proceedings SPEE 11 (1903):46-57. This paper also appeared under the title, "The Organization of Trade Schools: From the Point of View of a Trade-School Director," Journal of Proceedings and Addresses of the NEA (1903):612-617. According to Woodward, Robert H. Thurston was scheduled to go to the same NEA session to present the paper he wrote for SPEE, but that paper is not included in Proceedings and Addresses of the NEA. (Woodward's comment appeared in Proceedings SPEE 11 (1903):22.)


90. Dugald C. Jackson, "The Relations of the

91. Ibid., p. 370.

92. Ibid., p. 371.

93. Ibid., p. 376.


SPEE membership list, Proceedings SPEE 16 (1908):ix-lii.

The University of Wisconsin led the nation in the development of industrial education. In 1901, a few professors of engineering established a school for artisans in 1901. This school continued till 1906 when the University created an Extension Division, which supervised the outreach activities of both the agriculturalists and the engineers. In that division, the department of engineering extension provided technical instruction for thousands of workers and youths. With the assistance of the extension engineers, the State of Wisconsin further expanded the availability of industrial education in 1911, when it established a state wide system. Under the new system, many programs started by the engineering extension staff transferred to the control of the State Board of Vocational Education. However, the extension staff maintained many specialized programs and continued as a partner in directing industrial education in Wisconsin.
These developments in Wisconsin influenced, perhaps determined, engineering extension in Iowa. When funds for engineering extension became available at Iowa State College, two men agreed to leave their positions with the University of Wisconsin in order to begin a new extension department at Ames. These transplanted leaders to a large extent duplicated the philosophy and structure for extension previously developed in Madison. Thus, the roots of engineering extension in Iowa lay in Wisconsin.

Leadership in the early efforts in Wisconsin came from Professor J. B. Johnson. He had come to the conclusion that American education needed redirection if it was to train a workforce for new industrial conditions. For about three years, he urged SPEE to take up agitation for industrial education. However, speeches and reports did not satisfy him, and in 1901 he took other actions to institute his ideals. In the spring of that year, he accepted an appointment to an advisory committee, which made recommendations about educational programs to be established in a new school in Pittsburgh. This school, which received an initial funding of between 20 and 25 million dollars from the Carnegie fund, took the name, the Carnegie Technical Institute. The advisory committee
consisted of Robert H. Thurston, Victor C. Alderson, the President of Colorado School of Mines, Thomas Gray, Professor of Engineering at Rose Polytechnic Institute, and J. B. Johnson. These men met in Pittsburgh and toured the grounds for the school in April or May 1901. After each one wrote a report, they met again in June to prepare a consolidated report, which they delivered in Pittsburgh June 25.

This document, which appeared in full in both *American Machinist* and the *Proceedings of SPEE*, began with the claim, "It has become clear, both to educators and to business men, that the new century demands a wide dissemination of a new type of school training."(2) They proposed that the new institute have a three part organization, a technical college with entrance requirements "equal to those demanded by the best grade of existing colleges of engineering," a technical high school, and both day and evening classes "for the benefit of those who are unable to take advantage of the more complete courses in the Technical High School."(3) The committee also suggested the type of curriculum appropriate to each level of the institute. After delivering the report, all members of the advisory committee traveled to Buffalo, New York for the annual SPEE convention, which began four days
later. At the SPEE convention, the plans for the Carneige Technical Institute sparked discussion. Dugald C. Jackson characterized the plan as an "addition to the fabric of industrial training," for it provided a continuous system, "from its elementary branches advancing through the intermediate up to the highest education."(4)

In contrast to Carneige's school, Johnson had no need to plan such a continuous system. He instead directed his attention to the third function of the proposed technical institute, the training for adults not enrolled in the college. Considerable demand for such instruction already existed in Wisconsin. One engineer wrote, "During the past fifteen years there has been an ever-increasing demand from those engaged in other [non-agricultural] industrial pursuits, for trades training applicable to their special needs."(5) This situation had also produced to some complaints from legislators and newspaper editors about the isolation of the university from working people.(6) According to Johnson, those factors "caused us to feel we ought to try to do something for the industrial classes who can not afford to spend so much time in school."(7)

He planned to open a school, called a Summer School for Apprentices and Artisans on July 1, 1901.(8) As a part
of the promotion preceding the opening, the school became the topic of an article printed in American Machinist on May 23, 1901. (9) The article referred to Johnson's activity as chairman of the SPEE committee on industrial education. It also indicated that the summer school represented one way "to use the facilities of the university" in the promotion of industrial education. (10)

Johnson enlisted John G. D. Mack, an assistant professor of machine design from the University of Wisconsin as chairman of this program. As part of his preparation, Mack reviewed the University's short courses for farmers. He decided to utilize some features of that instruction, particularly the organization of a brief but intensive program. He hoped such a course might interest "machinists, carpenters, sheet metal workers, and electricians; stationary, marine and locomotive engine men; shop foremen and superintendents, superintendents of water works, electric light and gas plants, power stations, factories, and large office and store buildings...." (11)

The Summer School began on schedule, financed by $1000 from the University. It drew 45 students and offered them a selection from four courses, engine and boiler practice, applied electricity, machine design, and materials of
construction combined with mechanical power transmission. These courses, which ran for six weeks, provided both a unique and a powerful variety of technical training. A major strength of the instruction lay in the expertise of the teachers. They consisted of the director, John Mack, one professor, two assistant professors, and four instructors, all members of the faculty in the college of engineering. That group of "high power" teachers interacted with the 45 students, 28 local men and 17 students from the College of Engineering. The larger group included several draftsmen, two professors, one teacher of manual training, machinists, foremen, one railroad inspector, linemen, and machine-shop apprentices. To a large extent, this majority group did represent the population the organizers hoped to serve. The minority group, on the other hand, did not match such expectations.

The presence of the college students indicated the failure of Johnson's attempt to clearly separate the summer school for artisans from the offerings in the college of engineering. To mark that difference, Johnson had eliminated any reference to engineering in the name of the school and arranged to eliminate the awarding of any formal certificates for the work. With the use of these measures,
"there will be no danger," Johnson maintained, "of confusing its work with that of the regular courses in the College of Engineering." (14) These devices did not function as hoped, for the college students "took advantage of the facilities ... in order to make up shop work." (15) Just as the college training served as vocational preparation for non-engineers and those who quit school, so vocational programs served to enhance the practical skills of some engineering students.

The leaders of this school viewed the course as a great success, and Johnson recommended to the Acting President of the University, Edward A. Birge, that the school be continued "until some other provision be made for this class of technical workmen." (16) This did come to pass, for during the summers of 1902, 1903 and 1904, the University repeated the artisan training school. The only significant change involved a change in leadership following Johnson's death, so that in 1903, his replacement as Dean of the College of Engineering, Frederick E. Turneaure, took charge of the school. (17)

Even during its first year, the artisan school drew the attention of teachers in several schools and Johnson expected his program to rapidly draw emulators. He
asserted that other engineering colleges "will at once inaugurate similar summer schools and probably with the same titles."(18) The response in other schools came rather slowly and in small numbers. A supportive national organization might have supplied critical publicity, but in 1901, only the AAACES claimed to represent the land-grant institutions. At that time, the mechanic arts section had no vitality and numbered only one active supporter, Harry W. Tyler, a professor of mathematics at MIT.(19) Tyler included a summary of the summer school in his report of 1901, but held no hope that the Association might lend its power to the promotion of such educational programs. Despite the lack of active support from a national organization, a number of schools did follow Johnson's lead, though not, as he hoped, immediately.

In 1903, the Lowell Institute of MIT began a school for foremen in Boston. It took the name, School for Industrial Foremen, and comprised two courses, one mechanical and the other electrical, each lasting two years. The instruction, given without charge, occurred in the evening. In contrast with the summer school in Wisconsin, the school in Boston had entrance examinations in mathematics and drawing. It also required all applicants to be at least 18 years old, although the
average age of the students in the first four years was 27 years. The students generally already held an industrial occupation, more than half being draftsmen or machinists. According to the director of the Institute, the courses were "undoubtedly severe, and there are probably not a large number of men who are able to carry them."(20) During its first three years, it graduated about 90 foremen. This training had a dual purpose. It served the individual, bringing "more enjoyment and a higher salary" to the foreman, and it served American industry, because "the efficiency of the industrial art depends, in a very large measure, and probably to a constantly increasing extent, upon the capacity of its non-commissioned officers; in other words, upon the foremen."(21)

Not till 1905 did any other schools join the University of Wisconsin and MIT. In June, the Agricultural College of Michigan began a summer school which demanded no specific entrance requirements other than a "fair knowledge of the English language and of elementary arithmetic."(22) The courses, which ran from June 28 till August 9, included steam and gas engines, applied electricity, foundry and forge work, mechanical drawing, machine work, materials of construction, and "special instruction in arithmetic, algebra, geometry and
trigonometry."(23) A similar school sprang up the same year at the State College of Kentucky. It also held no entrance requirements and offered between June 8 and August 15 an almost identical list of courses.(24)

The summer of 1905 marked the fifth and final summer school for artisans in Madison. The final artisan school provided an important link to subsequent extension efforts in engineering subjects. During that last summer, the instructors made special efforts to coordinate their instruction with materials available from various correspondence schools.(25) As early as 1901, Dugald Jackson had suggested the value of correspondence courses in industrial education. He had even mentioned the artisan school in Madison as a location to establish this connection.

Jackson headed a committee in SPEE which analyzed the technical courses available from five correspondence schools. The results of that investigation led to his paper, "The Availability of Correspondence Schools as Trade Schools," presented to SPEE in 1901.(26) Jackson felt that correspondence work had little value in engineering education, but great value in industrial education. He cited several gas illuminating companies, members of the
American Gas Light Association, which had created a "Gas Education Fund," which payed for employees of the companies to take special correspondence courses. In reference to the artisan school, he asserted that "many subscribers to the correspondence schools will embrace this opportunity [summer school] to round out the character of the instruction which they are receiving." Although Jackson's idea did finally take hold in the last artisan's school, not till after the organization of the Extension Division in 1906 did correspondence instruction receive a prominent place in engineering extension. Before that occurred, several other colleges joined those seeking to redress the lack of industrial education.

Several programs which emulated the Lowell Institute School for Foremen began in 1906. Evening technical courses occurred under the direction of New York City College, Brooklyn Polytechnic Institute, and Columbia University. The work at Columbia, which began in November 1906, exemplified the evening school approach. Through its extension department, Columbia offered "a number of elementary courses in technical subjects, the instructors for the most part being drawn from the junior officers of our engineering school." The reception in New York shocked the organizers, for within a few weeks,
the school "had a registration numbering over four hundred and fifty."(31)

Some of these various programs, notably those at the Lowell Institute and Columbia, did outshine the Wisconsin summer school for artisans. However, starting in 1906 the University of Wisconsin created an Extension Division, which within a few years far surpassed the efforts of any other American college or university. A key figure in that change was the President of the University.

President Charles R. Van Hise lent powerful support to those desiring the University to develop its extension programs. His academic background may have predisposed him to value industrial education. He graduated in 1879 from the University of Wisconsin with a bachelor's degree in mechanical engineering and taught both metallurgy and geology for years in Madison. However, prior to 1905 he expressed little interest in extension projects and it took the efforts of the State Free Library Commission to alter his opinion.(32)

The librarians in Madison apparently had good relations with the engineers over a period of several years. In 1901, Charles F. Burgess, an assistant professor
of electrical engineering, delivered a paper at SPEE, "A Neglected Opportunity in Technical Education." That paper emphasized the value of the public libraries as a channel for technical information. It also led to a resolution which formed a committee to prepare a list of books on applied science and technology. In addition, the resolution requested the American Library Association to appoint a committee to work directly with SPEE.(33)

The librarians in Madison and their friends on the engineering staff set out to gain Van Hise's support. As a result of their efforts, Van Hise decided to support both industrial and agricultural extension work, and recommended funding for such activities. The budget, approved in October 1906, contained $7,500 for extension work, and in 1907, the amount grew to $20,000.(34)

At that time, promoters of agricultural extension had far better national connections than did the extension engineers. By 1905, agricultural extension leaders had already created a standing committee on extension in the AAACES. Van Hise joined that committee and for five years enjoyed the contacts it afforded. However, as a leader of industrial type extension, Van Hise had no such national organization to utilize. This situation made the search
for a director of the extension division rather difficult. Van Hise needed a man familiar with both agricultural and industrial problems and also devoted to the extension of university instruction. After considerable search, he selected a mechanical engineer as director. This man, Louis E. Reber, accepted the position in September, 1907, resigning his post as Dean of Engineering at Pennsylvania State College.(35)

It is likely that Dugald C. Jackson, Reber's brother-in-law, influenced Reber's choice to move to Madison and also his approach to extension work. Jackson served as the head of electrical engineering at the University of Wisconsin, starting his work there in 1891. Prior to accepting a position at MIT in 1907, he served as President of SPEE in 1905 and had worked closely with John B. Johnson before his death. Jackson expressed his views on the responsibility of the land-grant schools to provide industrial education in his paper of 1907 at SPEE. Reber took many of the notions voiced by Jackson and turned them into working programs.

Reber knew about the failure of university extension at Madison in 1890-92 and needed to establish the new work on a different basis. The old style of extension relied on
the personality of the extension lecturers. The burden placed on the lecturers was, according to Reber, too great, for they had to "combine the qualities of teacher, organizer, public speaker, scholar, and philanthropist." (36) This old system of extension had been described by Lyman W. Powell, previously an extension secretary at the University of Wisconsin, "It is not a system; it is a "man"." (37) In contrast to this mistaken approach, Reber said, "If today we desired to express educational extension in a single word, that word would be "University."" (38) Reber's meaning was that the new style extension relied, not on an individual, but on the combined expertise of all the faculty members.

In Wisconsin, the concept of university extension had been loaded, even from its beginning, with concerns for democraticizing education. In 1892, Frederick Jackson Turner quoted a University catalog of 1888-89, citing the words of President Thomas C. Chamberlin, "...it is no more impracticable to extend the popular range of University education than to extend the sweep of the University courses. It can scarcely be more prophetic to contemplate the higher education of the masses today than it was to look forward to the common education of the masses a few centuries ago." (39) Reber did not expect to bring a
university education to all, but he did expect the university to promote universal education. He felt that the extension efforts grew out of a widespread desire for universal education. "We have, then, a great national call for some method of popular education adapted to the needs of all classes—moneyed or poor, young or old, with or without education, laborer or person of leisure."(40)

Extension work stood as a division of the university with its own dean, independent from both the agriculture and engineering colleges. The extension division included four departments, correspondence study, instruction by lectures, debating and public discussion, and general information and welfare, each department with its own faculty.(41) Within this large framework, engineering extension fell under both correspondence and lecture instruction. To maintain order within engineering extension, Reber created three sub-departments, one each for civil, mechanical, and electrical engineering. Every sub-department also had its own departmental head and staff. From the start, Reber had good relations with the faculty in the engineering college, perhaps due to Johnson's concern for such instruction. Hostility from the engineers could have killed his plans, but their cooperation was "a big factor in developing and making
possible much of the successful work which was done."(42)

The intention of serving industrial employees led the extension staff to create instructional programs to meet the special needs of those students. At the schools for artisans, the instructors had made beginning attempts to utilize existing courses from correspondence schools. That plan functioned acceptably with many students, especially those seeking university credit, since they by in large required little supervision. However, many of the vocational students had quit public school and came with no workable study habits. To serve these students, the extension staff began to prepare their own correspondence materials, which they enhanced with local classes, often taught in commercial or school shops. This also afforded specialization, since in mining districts, the local courses treated mining engineering, while in manufacturing districts, courses focused on shop mathematics and machine design. In this manner, Reber proclaimed, university extension "offers vocational training directly applicable to prevalent industrial conditions in every part of the state."(43)

Under Reber's control, the extension division grew rapidly. The total extension staff, which numbered only 10
in July 1908, had grown to 59 by July 1910. The correspondence study department enrolled its first student in November, 1906, passed 1,000 students by July 1908, and in 1910, it numbered 3,500, of whom about 800 were working for university credit. About 2,000 people were in special studies with "vocational bearings." In the Milwaukee district alone, over 1,000 students enrolled in vocational study in 1908-1909. By 1914, extension at Madison included 31 full time instructors in correspondence instruction, with 35 part time. To facilitate the field work, Reber divided the state into six districts, each with a local office, itinerant instructors, field organizers, clerical workers and university representatives.

As this work grew, it attracted the attention of journalists as well as educators. Lincoln Steffens, who figured as prominent "muckraker" and won fame in 1904 for his book The Shame of the Cities, visited Madison. His investigation of the University led to an article, "Sending a State to College," published in February, 1909, in The American Magazine. Instead of citing the college as a seat of corruption, he praised its extension efforts, calling it "the University that reaches anybody, anytime, anyhow." Though he devoted most column inches to agricultural
extension, he mentioned the special vocational studies, shop mathematics, electrical and mechanical engineering along with the other aspects of extension. However, the value of the article lay not in its collection of data on the extension programs but in its praise of the principle of extension. The work at Madison displayed "the true birth of the pure idea of universal university extension. No thought in that of money for the university; no philanthropic fad—notion about culture for the masses; nothing but the instinct for democracy and needed service." (49)

Though Reber did not cite Steffens, he carried forward the view that extension meant service to the state and nation in his paper for the meeting of SPEE in 1909, "University Extension — "An Instrument of the State in its Upbuilding."" In it Reber laid out the developments at Madison, including its principle justification. "In Wisconsin it is believed that the university, controlled and supported by the state, should be of service to all the people of the state in all their needs." (50) One of the foremost needs of the state involved education for the 600,000 youths under nineteen years old who were not in schools of any type. (51) The upbuilding of the state directly required training for these students, but because
many of them did "not know how to make use of schools, even
of those designed especially for them," education needed a
new setting. For Reber, the work shop provided this twist,
for it emphasized the connection between the academic
lessons and the realities of employment. Under the
direction of a competent extension instructor such a
workshop became an educational laboratory, in which all
lessons gained meaning for each student by the convention
of expression "in terms of their trade."(52)

In the SPEE discussion following Reber's paper,
Mortimer E. Cooley, Professor of Mechanical Engineering and
Dean of Engineering at the University of Michigan, said,
"The work that Professor Reber has described is, in my
opinion, one of the most important being done in the United
States."(53) Dugald C. Jackson voiced similarly positive
comments and again, as he did in his paper of 1907, charged
the engineers to take up leadership positions in the
industrial education movement. He maintained that common
school teachers, the manufacturers, and the professors of
education in various colleges could not successfully
organize industrial education in America. That task
required "the co-operation of the engineering teachers, the men who own the industries, and the more altruistic of the great industrialists." (54) The expected role for the engineers in the movement had clear definition. Jackson did not want industrial education to become part of the college curriculum, but he did expect the engineers to accept the task of "supervising it and seeing that it is broadly organized." (55)

Though Reber had the support of Jackson, Cooley and a few other members of SPEE, the Society as a whole made no move to even request the Committee on Industrial Education to further examine engineering extension. Prior to the SPEE meeting of 1910 at Madison, Reber included in the Bulletin of the SPEE the plea, "All members of the Society for the Promotion of Engineering Education who will attend the next meeting of the society at Madison, Wis., are respectfully urged to investigate the methods of the extension department." (56) Those already sympathetic to extension had the opportunity to examine Reber's department, yet again SPEE initiated no reports or investigations of its possible role as a promoter of engineering extension. Reber had to promote his ideas without the support of a national organization.
He did not hesitate to seek national exposure for his ideas and presented papers at major conferences. In January, 1910, he delivered a paper at the eleventh annual conference of the Association of American Universities, which occurred in Madison. Reber's paper, "University Extension," reviewed the history and philosophy of extension work and summarized existing extension programs. Although the report indicated that 23 state universities and colleges offered extension work, the vast majority of them provided only agricultural work, for the engineering efforts had not yet bloomed. (57)

Reber also published an article "University Extension and the State University," which he had previously presented at the American Association for the Advancement of Science, in the journal Science in December, 1911. It again offered Reber an opportunity to propagandize for extension. In justification of the appropriateness of extension activities in a university, he asserted that "so long as there is no other agency prepared to do the work," then universities have to conduct extension, whether or not those activities conform with a definition of the ideal university. (58) As extension activities gained popularity and later spread to many land-grant institutions, such a justification came under criticism from the opponents of
extension, thereby forcing its advocates to re-think the role of American universities. However, well before that debate gathered steam, Reber affiliated a portion of the extension work with a mission judged to be well within the scope of the university, namely the training of teachers.

As the engineering extension activities expanded, the search for qualified teachers led extension staff into close ties with teacher training programs. The extension workers in Madison encountered the same problems which arose earlier in the rush to find teachers for manual training high schools. Following Woodward's promotion of manual training high schools in the 1880s, many such schools sprang up, particularly in large cities. At the time, no formal programs for manual training teachers existed. To fill the demand, schools recruited men both in shops and industries and from college graduates, usually young engineers. In addition to the manual training high schools, instruction in industrial skills and arts began to enter most high schools in the 1890s and 1900s. This created even more demand for qualified teachers and made teacher qualifications a "hot" issue, leading to its
discussion in 1901 in a lengthy exchange of letters in

American Machinist.

J.B. Stanwood, the director of the Cincinnati
Technical School, began the exchange, mentioning that
manual training schools drew teachers either from skilled
workmen in various shops or from graduates of technical
schools, young engineers. While the shop men had high
skills and the college graduates a technical education,
both groups fell short as teachers. "Neither of these two
classes can be considered as teachers - in the sense that
they ever have had proper training in the art of
teaching."(59) His intent in writing the letter was to
stir discussion about "the best methods for raising up a
corps of teachers in our land to fill the thousand places
which stand open for them."(60)

Stanwood succeeded in his intent, for response began
three weeks later with a letter from R. W. Hargrave, an
instructor in mechanical practice at the University of
Wisconsin. He pointed out that one factor contributing to
the dearth of teachers for manual training came from low
wages. He felt the poor teachers in those schools
reflected the mistaken set of priorities, asserting, "Can
we expect it to be better when the salaries offered to
instructors in this branch are on the average hardly as high as those which can be obtained by a second-grade, poorly educated machinist?"(61)

The following issues of American Machinist contained a flurry of letters on the topic. One man suggested that teachers of manual training should come only "from the ranks of foremen who have a record as skilled artisans and also for making good mechanics out of their apprentices."(62) Another reader emphasized Stanwood's position, complaining about incorrect use of English by some skilled mechanics turned teachers and the incompetence of some college graduates. He asserted the combination of mechanical ability and a technical education is "a rare one, and is seldom met with."(63) Four letters appeared in March, generally focused on the conflicting definitions of the purpose of manual training schools. All four writers agreed that manual training schools and trade schools, also called technical schools, had different purposes. The trade schools aimed at the training of draftsmen, machinists, blacksmiths, and other artisans. In contrast, the manual training schools sought the general manual development of the students without reference to any specific occupation. That group of men generally characterized the teachers of trade schools as shopmen,
with high skills in specific areas, while the manual training teachers tended to come from the colleges. One man claimed that in New England, approximately 85% of manual training teachers came from colleges. (64) Another felt that such teachers needed to be practical men, but more important, they needed to have "a knowledge of the aims and value of manual training." (65)

If the figure for New England held relative accuracy, the most popular training for these teachers occurred in colleges, however some writers objected to that trend. One writer reviewed the definitions of manual training, feeling that if it meant "a teaching of the mind by employing the hand," then its teachers should be college graduates. If it meant teaching "the use of machinery," then the "shop graduate was the man for the position." If it meant a combination of the two types, which definition the writer favored, then he felt the shop graduate could do a better job. (66)

This debate not only shed light on the problems of finding qualified teachers to staff manual training courses, it also demonstrated the willingness of young engineers to enter the teaching profession. Some graduates approached teaching as a temporary position, as indicated
by Hargrave. He wrote that several excellent teachers took positions "for a short time to be so situated that they can take advanced work in our universities."(67) Whether the young engineers took teaching posts for short or long terms, their presence in the educational field stemmed to some degree from the claims that engineers should exhibit a sense of social responsibility.

Shortly after the start of the extension division in Wisconsin, the Merchants' and Manufacturers' Association of Milwaukee invited the extension division to establish industrial instruction.(68) The teachers supplied by the university were, as in many manual training schools, college engineering graduates. One of such men working in Milwaukee, who later headed engineering extension in Iowa, was Kenneth G. Smith, who began his work as representative of the Milwaukee district in November 1909.(69) This type of instruction did not remain for long within private industry, for the public schools desired similar courses. Starting in the fall of 1910, evening courses ran in the West Allis high school. Since the school had no qualified teachers of the technical subjects desired, the extension division supplied the teachers, and the West Allis schools paid the University for the services.(70) Reber felt this cooperation with the public schools represented the tip of
an iceburg, claiming that the "introduction of vocational training in all schools, whether in cities or villages, becomes possible, through the instrumentality of the university extension division, at a cost which any school board should be able to meet."(71)

At the same time as the engineering extension workers began cooperation with the public schools, the University established a department of Manual Arts in its College of Letters and Science.(72) The choice to locate the manual arts department in the college of letters and science caused some concerns, for the director of the teacher training courses characterized the decision as one "for convenience of administration."(73). The organization of both the courses and facilities fell on those engineers who had previously directed the summer school for artisans, namely Dean Turneaur and Professor Mack, and one additional engineer.(74) The head and organizer of the new department was Fred D. Crawshaw, a graduate of Worcester Institute and former instructor in manual arts at Bradley Polytechnic Institute and also assistant dean of engineering at the University of Illinois.(75) Under his guidance, the new department relied on the cooperation of the college of engineering and the departments of education, home economics, and agriculture. The new
department offered a four year program, principally designed to prepare teachers of manual arts.

Once the Department of Manual Arts began work in Madison, the ties with engineering did not disappear. One year after its founding the new department began work with the extension division. By October, 1911, R. W. Hargrave took the position as itinerant instructor in charge of manual arts teaching in four small communities in Wisconsin. (76) The bureaucratic arrangement placed the administration of the circuit in the extension division, with the supervision and instruction provided by the department of manual arts. This plan involved Hargrave in instruction in drawing and bench woodwork in each of the four towns one day per week, with assignments and instructions for the other days. The local communities had to defray the expenses of such instruction and hoped to receive in turn teachers for manual training courses. (77)

The early efforts to organize training for manual arts teachers dovetailed with one of Reber's major goals, the establishment of a state wide system for industrial education linked to the public schools. In Wisconsin, the interest in industrial education far exceeded the potential for the university extension work to fulfill, even though
It became the largest extension program in the nation. In 1909, a group of concerned citizens who were not directly linked with the schools or universities led a movement for industrial and agricultural education as part of the public educational system. This action led to a resolution passed in the Wisconsin Senate in 1909 that a commission be created to prepare a report on industrial and agricultural education. This commission consisted of C. R. Van Hise, President of the University of Wisconsin, L. E. Reber, Director of the University Extension Division, Dr. Charles McCarthy, the librarian of the legislative reference department, and the man who first initiated actions to organize the call for industrial education, C. P. Cary, State Superintendent of Public Instruction, and C. G. Pearse, the superintendent of the Milwaukee public schools. (78) This commission delivered its report to the Legislature of the State of Wisconsin on January 10, 1911. (79)

This report reviewed the conditions in Wisconsin and made specific recommendations about industrial and agricultural education. Perhaps because of the long-standing work in agricultural extension, the bulk of the report, 100 pages, concerned industrial education while agricultural education received only 19 pages. For
industrial education, these recommendations were 1) the creation of a state advisory board for industrial education, 2) establishment of local boards for industrial education, 3) the development of continuation schools for students between 14 and 16 years, which were to be mandatory, 4) state financial aid for industrial education, 5) updating of apprentice laws to make them compatible with the educational system, and 6) increased appropriations for the extension division of the university.(80)

Acting on this report, the Wisconsin legislature created a state board of industrial education, consisting of 9 members, the State Superintendent of Schools. The Dean of University Extension, the Déan of the College of Engineering, three employers, and three skilled laborers.(81) The engineers took a position of continuing leadership in the efforts of the state to provide vocational education. While the developments in Wisconsin public schools go beyond the scope of this essay, the role of university extension in this effort directly reflected the role Reber and his extension workers envisioned for the engineers.

In the infancy of the state system for industrial education, the extension division came under a heavy load
to assist its development. In some cases, extension courses already existing come under the jurisdiction of the state. This was true of a number of courses for apprentices in the machine trades in Milwaukee. Under the system for continuation schools, the technical education was "practically the same as that they [the apprentices] have had in their Extension Division classes."(82) However, under the new system, students took additional courses in English, safety, hygiene, and citizenship. Even in Milwaukee, the public schools could not immediately take over the work, consequently the city "contracted with the Extension Division to give the apprentices in that city the required instruction."(83) Besides continuing the established work, school boards in Racine and Kenosha joined the West Allis schools in hiring extension staff to conduct industrial courses.(84)

As the state system matured, it took over many of the courses previously taught by the extension division. In Milwaukee, with the co-operation of the extension workers, the Continuation schools took over the courses, and the resulting change "cut heavily upon the Extension registrations," and necessitated a reorganization of the extension work. Similarly, the correspondence work changed, with a major decrease in enrollments in general
industrial education, and an increase in specific courses in mechanical engineering. (85)

The extension staff expected to have a temporary role in some aspects of the state system. The role had even been compared to the work of circuit riders in early church organization. Temporary local instruction, first started by the extension instructors, grew to become permanent aspects of the local schools, thereby eliminating the need for extension instructors. (86) Particularly in Milwaukee, this process occurred repeatedly, with local extension classes spurring the hiring of permanent teachers in established vocational centers.

The temporary part of the work, if done well, would mean the elimination of the presence of the university extension. However, that was true only at the local level. Another aspect of extension included a permanent slot for extension as a part of the state plan for industrial education. The bottom level contained the continuation schools, providing basic technical training. High level training occurred at the college of engineering, and apparently the original plan of 1911 projected various levels of schools linking the continuation schools to the university. "The plan apparently in the minds of the
commission was to provide for a continuing system of education which would only be begun in the continuation school and which would be carried higher by the other state educational agencies."(87)

Wisconsin established its state system for industrial education before 1917 and the Smith-Hughes incentives. Consequently, as the state system grew and took over basic vocational education, the university extension forces altered their emphasis. In 1915, one of the engineering extension professors advocated the continuing presence of the engineers in the vocational system. He imagined the highest possible development of industrial education in the public schools, including evening schools, part-time apprentice schools, mechanics' institutes, trades schools, and other speciality schools. Even with such thorough development, local schools could provide instruction only in those fundamental subjects which maintained adequate enrollments for several years. While even large cities could not provide specialty classes, which might be offered only one time, university extension could fulfill that need for the entire state. Particularly as the content matter advanced to relatively high levels, "the necessity for University Extension in industrial education is even more apparent...."(88) Along this line, the university offered
over 70 relatively specialized courses, and would deliver this instruction in cities whenever enrollment warranted the effort.

To a large extent, this role for the engineers amounted to the preparation of highly specialized technical training, both the creation of curriculum materials and the delivery of the information. The field appeared immense, for even with the 70 courses available, the "field has hardly been touched."(89) This role of developing specialized curricula was to provide a long term presence of extension in the state's system. However, extension also kept close ties with teacher training, another continuing need.

Not only did Professor Crawshaw of the Manual Arts department copy many of the procedures established by the extension workers, he maintained direct working relations with some members of the extension staff. Starting in 1912, the university provided funds for an Industrial Teaching Scholarship. It sought to attract "some of the younger, skilled craftsmen from industry into the ranks of teaching," and provided financial assistance to a few such men.(90) This program involved the efforts of Professor Crawshaw and K. G. Smith, who had left his job as district
representative in the Milwaukee area when the enrollments there began to decrease.\(^{(91)}\) This effort directly involved the extension division in the teacher training mission. Though Smith left this work to relocate in Ames, the retraining of skilled craftsmen in pedagogical techniques continued, with particular success in the Milwaukee area. This work also called on previous ties established by the extension workers with the Milwaukee public school system. The selection of only the best qualified tradesmen allowed the acceleration of the teacher training courses. Reber asserted that it was possible "to give training and teaching experience so closely related that a comparatively short course is quite effective...."\(^{(92)}\) The teachers prepared in this manner took jobs in the public schools and also several post-secondary institutions, including Oshkosh State Normal school, Stout Institute, and Highland Park College.\(^{(93)}\) By the start of the 1916 school year, 42 teachers had been trained and placed in this manner.

Summary

In Wisconsin, J. B. Johnson put his ideals into practice and established training for artisans. This type of technical instruction under the direction of the
engineers also sprang up at MIT, Michigan Agricultural College, the State College of Kentucky, New York City College, Brooklyn Polytechnic Institute and Columbia University. In 1906, President Van Hise under urging from the Library Commissioners recommended funding for a division of university extension. In that division, the engineering extension department set up a variety of courses for industrial workers and youths. The director of the division, L. E. Reber promoted engineering extension in the SPEE, and in articles and speeches at other national education organizations.

In order to secure well-trained teachers, the extension engineers worked closely with the Manual Arts Department and public school officials. When Wisconsin established its system for industrial education in 1911, the engineering extension workers turned over many local courses to the public schools, but maintained a number of specialized courses. They also continued to create curricular materials and assist in teacher training.

When K. G. Smith accepted the position as director of the yet unformed engineering extension work at Ames, he brought to that situation the general philosophy of extension work promulgated in Madison. In addition, he
transplanted many specific notions about the organization and scope of extension. In contrast to the University of Wisconsin, Iowa State formally separated engineering extension from agricultural extension. Consequently, Smith had the opportunity to put together a program with a single focus, engineering extension.

However, winning initial funding for the department at Ames required considerable effort from a number of groups and individuals. Those supporters gathered their forces between 1908 and 1912, relying heavily on a group of Iowa manufacturers. The molding of their concern for industrial education into requests to establish a new department at Iowa State University necessitated the influence of two national organizations and one dedicated engineer.


3. Ibid., pp. 192-194.


7. Ibid.


10. Ibid.


13. Ibid.

"The Summer School of the University of Wisconsin," American Machinist 24(49) (5 December 1901):1337.

9 (1901):326.


"The Summer School of the University of Wisconsin," *American Machinist* 26 (7 May 1903):645-646.

"The Summer School of the University of Wisconsin," *American Machinist* 27 (7 April 1904):471.


21. Ibid., p. 510, 511.


23. Ibid.


27. Ibid., p. 102.

28. Ibid., p. 104.

29. "Report of the Committee on Industrial


31. Ibid.


35. For details on correspondence between Reber and Van Hise, see Curti and Carstensen, pp. 559-562.

37. Ibid.

38. Ibid.


49. Ibid., pp. 358-359.

51. Ibid., p. 117.

52. Ibid., p. 115.


54. Dugald C. Jackson in discussion, Proceedings SPEE 17 (1907):119. In the Proceedings, these remarks are attributed to Professor Jackson, not specifically Dugald C. Jackson. John P. Jackson also held SPEE membership, but these comments cannot have come from him because of references to "personal observation" of the industrial education wing of university extension in Madison and talks "with the Milwaukee manufacturers." These references indicate the correct author was D. C. Jackson, who had lived in Madison.

55. Ibid.

of the SPEE 18, No. 1 (June 1910):xli.


60. Ibid.


70. Ibid., pp. 236-237.

71. Ibid., p. 238.


74. Ibid.


78. Report of the Commission upon the Plans for the

79. Ibid.

80. Ibid., pp. 9-10.


83. Ibid.

84. Ibid., p. 185.


89. Ibid., p. 112.


93. Ibid.
In the years between 1908 and 1912, several organizations and individuals came to see engineering extension as a potential source of industrial education for the State of Iowa. In activities to sell the concept of engineering extension to the legislators of Iowa and to win its acceptance as an major new educational form, three organizations and one individual stood out as leaders. The Iowa State Manufacturers Association, hereafter ISMA, provided leadership on the political level, for its members effectively promoted the extension funding. The YMCA through its Industrial Department appealed to the social conscience of engineering students to recruit them into an industrial service movement. That call drew students in Ames into educational work with workers, predominantly railroad men. Anson Marston, Dean of Engineering Division of Iowa State College, hoped to increase such types of service and lent his support to the ISMA. In 1912, the
Land Grant College Engineering Association at its founding meeting proclaimed engineering extension one of its two primary concerns. In so doing, it raised engineering extension from a rather obscure status in only a few states to controversial national notice. These four elements each helped establish engineering extension in Iowa.

ISMA's Promotion of Industrial Education

The ISMA began in 1903 and took as its chief objectives the mutual benefit of its members, the dissemination of knowledge relevant to manufacturing, and the general advancement of the interests of Iowa Manufacturers. (1) It maintained ties with the National Association of Manufacturers, NAM, an organization which formed in 1893. The NAM drew members from representatives of state or local manufacturers associations as well as individuals engaged in manufacturing. (2) In NAM, both technical and commercial education became topics of discussion in many national conventions following 1896. Those discussions began an extensive involvement of the NAM in educational issues. Between 1902 and 1917, the organization poured considerable time and effort into the lobbying activities that led to the Smith-Hughes act. (3)
While the NAM generally restricted its support to secondary education, the ISMA became involved in efforts to start engineering extension in Iowa.

When the ISMA first began to promote industrial education, it did not mention the concept of engineering extension. At its annual convention in 1908, held in Ottumwa, the manufacturers included industrial education both as the topic of an address and in a resolution. Bohumil Shimek, Professor of Botany at the University of Iowa, delivered the talk, "Industrial Education." It stressed the need for teachers proficient in both technical and pedagogical skills. The manufacturers also passed a resolution calling for the establishment of manual training departments in public schools. The resolution also indicated the ISMA favored an increase in the "facilities for acquiring an education in agriculture, mechanic arts and domestic science by the establishment of additional schools throughout the state." They had at that time no definite suggestions as to who should take up the task of improving industrial education. However, they did stress technical education, and maintained that "the state can spend money for no better purpose than to promote, in all practicable ways, the industrial education of coming generations."
The following convention devoted much more attention to industrial education. That gathering, held in Davenport June 9-10, 1909, heard a report of the industrial education committee. That committee, which probably formed sometime in 1909, indicated that the efforts of the ISMA had spurred an "awakening along this line in Iowa...."(7) While the committee expressed pride in this success, it also complained about the inadequate number of teachers of manual training. The state schools, the members felt, remained unresponsive to the call. They claimed that "much more should and would have been accomplished could we have had a reasonable degree of cooperation by the state educational institutions in the preparation of teachers in manual training...."(8)

Before the ISMA convened in 1910, the first mention of industrial education within the Division of Engineering at Ames occurred. On May 23, 1910, Anson Marston began the procedure required to receive permission from the State Board of Education to outline a new course. The course, fashioned on the two year course in agriculture, took the designation, "the Two Year Course in Engineering."(9) On the following day, a committee on course of study recommended a tentative outline for such a course,
including the same requirements in math, history and English as established in the two year ag-course. (10)
Nothing came from this proposal, but it did indicate that Marston felt some pressure to establish courses for non-engineers. However, no connection developed between Marston's notion and the hopes of the ISMA.

The eighth annual convention of the ISMA occurred in Marshalltown, June 9-10, 1910. The manufacturers considered the topic of industrial education one of their first orders of business. It served as the theme of the keynote address, delivered by Judge Horace E. Deemer of the Iowa Supreme Court. (11) He urged the development of manual training in both public schools and the creation of special technical schools. He maintained that such training was essential to make Iowa into a significant manufacturing state. Deemer's comments led the members to place new emphasis on industrial education. They in turn resolved to recommend that the Iowa legislature should create a plan for state-wide industrial education.

Shortly after the ISMA convention, the notion of industrial education led by engineers received additional support. In July, Louis Reber traveled to Ames to attend a series of meetings on agricultural extension. (12) He
delivered a speech, "University Extension," which focused on agricultural extension, but also included a section on "The Industrial Student." In this section, Reber discussed the potential of extension to serve the needs of industrial workers for vocational training. Just as agricultural extension courses provided education for those in rural districts, so industrial courses could serve those in mining or manufacturing districts. He cited shop mathematics and machine construction as examples of courses appropriate in manufacturing districts. He also asserted that if properly organized, university extension could offer "vocational training in every part of the State directly applicable to the prevalent conditions."(13) He in effect advocated that university extension in Iowa should create a system for vocational and technical education.

Reber's idea did not take hold in the ISMA till after the 1911 convention. At that meeting, the President, F. H. Keys, asserted that the creation of trade schools was "the most important thing" for consideration by the ISMA. The past resolutions of the manufacturers had not led to adequate industrial education. In fact, Keys complained that only in two communities, Anamosa and Fort Madison, could students receive training in trades.(14)
Consequently, the ISMA sought another line of approach.

Following the convention, the Secretary of the ISMA initiated the new tack and sometime in late 1911 or early 1912, arranged to meet with Marston. They discussed the need for systematic industrial education in Iowa. As a result of the meeting, the ISMA asked the engineering division to assist in working out a system of industrial education for the state of Iowa. In turn, the college of engineering conducted a study of industrial education in Iowa and developed a statewide plan.

Marston's decision to join the ISMA in the promotion of industrial education directly led to the creation of a department of engineering extension in Ames. A number of factors influenced that choice. He knew about the work organized by Reber in Wisconsin. He also shared the view that engineers held a position of social responsibility. An additional facet came from his awareness that many engineers and engineering students eagerly volunteered for educational service work. In particular, he knew about the successes of the Industrial Department of the YMCA.
The YMCA began its outreach to industrial workers in the late 1800s. It purchased and rented buildings for meetings in an attempt to bring to the more than one million railroad employees a "homelike atmosphere, social attractiveness, and sane and simple religious features." With these efforts, the YMCA leaders hoped to provide "the comforts and the social and moral environment of the home life."(16) In 1903, the successes of the railroad work spawned a new department, the Industrial Department of the International Committee of the YMCA. A large portion of the work involved elementary instruction in English for immigrants, with classes which claimed an enrollment of 17,000 in 1912.(17)

However, the organizers of the work were not content with traditional social service. They formulated a new approach, one designed to avoid identifying the YMCA with either the owners or employees of American industries. George W. Perkins, a prominent financier and director of the finance committee of the YMCA, summarized the approach
in an article titled, "Big Industrial Movement to Aid Capital and Labor." He characterized the industrial service movement as "a silently developing triumph of practical Christianity," which was overcoming disputes between the two sides. According to Perkins, that style of social work differed "from all ordinary methods of uplift work." The difference inherent in the new style stemmed from the YMCA's detailed analysis. The new programs relied on "careful and scientific studies of the home life, the work life, and the recreative life of men and boys in the industries."(18)

Armed with a supposed scientific approach, the industrial service work grew steadily and in 1906 began to recruit engineering students. The first such students to join in service for both capital and labor came from the Sheffield Scientific School of Yale University. Under the guidance of the staff of the industrial department, the volunteers began to conduct meetings in shops and factories about first aid and the prevention of disease.(19)

The work begun at Yale spread to other engineering schools. Students gave their time to provide instruction in English, history and citizenship to foreigners, and also in specific technical areas, such as drawing, electricity,
and manual training. (20) Beside utilizing students, the YMCA also kept in touch with sympathetic men after they graduated, thus building up a pool of practicing engineers who supported the outreach work. By 1913, over 2000 such engineers appeared in the YMCA's records. (21)

As the industrial service movement grew, the YMCA had to expand its Industrial Department. By 1912, it employed 10 full time workers, called international secretaries, plus a number of part time helpers. Those ten carried out projects of great variety. One devised new methods of industrial work in large city YMCA's, two covered immigration work with its English instruction, four located in mining, textile, lumber or construction camps, and one recruited student engineers. This last man, Fred H. Rindle Jr., took as his job engaging students "in forms of service that bring them into relation to industrial workers, learning to know and understand them and their needs, so that when these students become engineers they will have more intelligent regard for the welfare of the workers." (22)

Rindle brought his message to Ames in the Spring of 1912. His speech, printed in the Iowa Engineer, emphasized the service of other engineer recruits to the industrial
service movement. (23) He announced that in 1912 at least 1,000 engineering students had joined in about 40 types of volunteer service for working men and boys. (24) The efforts of these student engineers in "spreading the gospel of service" involved them in a solution to problems caused both by immigration and the conflict between capital and labor.

Rindge stayed in Ames a few days and easily demonstrated the need for industrial service. He reported a demand for at least three different classes in English for foreigners and even managed to organize on the spot a class for 15 Austrians in a box car on the railroad tracks. (25) In addition, he contacted a number of American workingmen who requested instruction in mathematics and mechanics. He felt that local labor unions might provide space for students to conduct such classes.

The concept of social responsibility permeated Rindge's appeal to the students. In the YMCA's programs, they could provide valuable skills and knowledge to working men. Also, they stood to become engineers "with an entirely different feeling toward working men, with an entirely different spirit for service and with a sense of personal responsibility. . . . "(26) Rindge held high hopes
for the influence such socially motivated engineers might have on American industry. If enough students acquired this spirit of service, the results should be revolutionary. "As hundreds of engineers continue to go forward from our colleges and technical institutions with this new spirit of service in their hearts and this sincere desire to improve conditions and help men, not one of us can prophesy how much better a place the industrial world of tomorrow will be."(27)

Rindge's message stirred some response in Ames, though not as great as he hoped. Volunteers took up the English language instruction for railroad men.(28) Apparently, a few students became rather committed to that work, for it continued for at least three years. In early 1915, a group of six students continued to provide English instruction for laborers on the Northwestern Railroad.(29)

Rindge experienced greater success at other schools. During a two day stay at Cornell, 1,600 students heard about the industrial service movement, of them 525 expressed some desire to help and 130 immediately volunteered.(30) In addition to Cornell, Iowa State, and Yale, Rindge also successfully recruited at state schools in Massachusetts, Illinois, Indiana, Pennsylvania,
Wisconsin, South Carolina and California as well as colleges such as Amherst, Princeton, Cornell, Worcester Polytechnic, McGill, Puget Sound, Furman, Columbia, Harvard and Brown. Thus, Rindge brought the message of service to thousands of engineering students throughout the nation.

In Iowa, the socially oriented students found an ally in Anson Marston. By 1912, he had come to feel that engineers needed to educationally serve working men and youths in Iowa. He gave credit to the ISMA for the earliest promotion of industrial education in Iowa. He even apologized for the fact that the college "did not have quite foresight enough to take the initiative." Once he joined the ISMA in its promotion, he rapidly became a central figure in the struggle.

Marston's Plan

In March 1912, Marston published part I of an article "A System of Industrial Education for Iowa" in *Iowa Factories*, the monthly journal of the ISMA, finishing the article in the May issue. The article went into print in the months just prior to the annual ISMA convention, thereby tending to position the topic as central in the ensuing discussions. Arguing that "Iowa has been
giving, not too much, but too exclusive attention to agriculture," Marston stressed the need for industrial education.(34) He claimed that both employers and laborers desired industrial education. Population shifts supplied another type of demand. Iowa contained only a few cities and they remained tiny compared to Chicago and St. Louis. Consequently, "Iowa has so far largely been free from the evils and difficult problems of the large city."(35) However, according to a recent study by the engineering experiment station, the rural population had been declining, while towns had grown substantially.(36) The time was then ripe to study "how to prevent these evils," and at the same time to adopt "the soundest and best plans for industrial and social betterment."(37)

Marston felt that the public schools were in no position to adequately deal with industrial education. He did cite the rapid growth in manual training departments, which numbered only 7 in 1900 and included 92 in 1910. However, that increase did not provide industrial education. He saw a major difference between manual training and industrial education, arguing that manual training "does not, however, fit young men for any specific trade, and hence fails to meet the real aim of industrial education."(38)
Although Marston downplayed manual training as a solution to Iowa's lack of trade training, that did not imply that manual training had little connection to the engineering division. On the contrary, the engineering departments directly influenced the manual training programs, for they provided many teachers for the public schools. The growth pattern Marston indicated in his plan continued, and by 1914, 150 schools in Iowa had established departments for manual training or manual arts. (39) The numbers of trained teachers of manual training fell far short of the demand, so engineers began to take positions in public schools.

Both graduates of the engineering course and drop-outs took manual training positions. It is likely that many graduates taught only for a short period, as also occurred in Wisconsin. (40) However, a number of engineers entered public education and never left. Evidence indicates that both mechanical engineers and electrical engineers filled those positions. (41)

The case for engineering drop-outs as manual training teachers is more circumstantial. A rough estimate of the drop-out rate can be calculated from the lists of students,
and of the 216 freshman who listed engineering as their field of study when they entered in 1904, only 71 graduated from Iowa State College. Since those students received shop-work beginning in their freshman year, those who stayed one or two years developed significant skills. It is likely that a number of the drop-outs entered teaching, especially in light of the certification requirements at the time. Until 1911, Iowa public school teachers received either a State license or a county certificate on the basis of a written examination prepared by the State Board of Examiners. This system did not require teachers to possess a four year college degree, and it is likely that drop-outs from the engineering school in Ames could pass the exam. However, since at that time Iowa State College maintained no records on its drop-outs, it is difficult to document these suppositions.

Regardless of the number of engineers in manual training jobs, Marston felt adequate industrial education required two new types of schooling, industrial schools and industrial extension. He suggested funding of $50,000 and $35,000, respectively, for these schools. Industrial schools had appeared in the ISMA resolutions beginning in 1908. Marston merely provided concrete suggestions for organizing such schools. They should have direct
coordination with the public school system, yet have administrative control in the hands of technical men and industrial employers. Some of the schools in Wisconsin served as a model for this portion of the plan, for they displayed local control, acceptance of state regulations, and provisions for both day and evening classes.

Specific mention of industrial extension had not previously appeared in ISMA recommendations. As it turned out, by the time the legislature funded industrial education, the plan for industrial schools no longer appeared, leaving industrial extension as the sole recipient of monies. Thus, Marston had the effect on the ISMA of redirecting its general concern for industrial education into an effort to fund a new department at Iowa State College.

That selection of the engineers as leaders of industrial education fit nicely into Marston vision of industrial education. He felt industrial education held generic meaning, referring to all education which prepared individuals for specific occupations in industry. Engineering education occupied only one place within industrial education. (44) It also included a portion centered on trade training, a particularly difficult
program for colleges to successfully conduct. He wrote, "In common with the other land grant colleges the attempt was first made to establish mechanic arts work of lower than college grade...." (45) According to Marston, the difficulty with the non-collegiate courses in engineering lay in the immaturity of the students who needed such work. "Bitter experience has forced or is forcing all the land grant colleges to do work of strictly college and professional grade, both in engineering and in agriculture, for the boys of 14 to 18 years of age, who need trade school work, will not go off to school at a distance from home." (46) A long term solution involved the establishment of many trade schools scattered throughout the state, but such a change would require years to develop. Through industrial extension, the engineering division could provide an immediate remedy and, at the same time, keep the leadership of industrial education in the hands of the engineers.

Marston's plan became a central topic at the 10th annual convention of the ISMA, which occurred on May 8, 9, and 10, 1912 in Sioux City. The first session included the annual address of the president, Mr. B. J. Ricker of Grinnell. He spoke about industrial education, saying "What Iowa most needs is an awakening to the great
 possibilities of her industrial development."(47) Ricker repeated Marston's major points about a system for industrial education and concluded his speech with several recommendations, the first of which read, "As this is the convention before the Thirty-fifth General Assembly I wish to recommend for special consideration the following measure: First and foremost a system of industrial education for the state of Iowa."(48)

The second session continued to focus on industrial education. The program was to include a speech by Louis Reber. Due to illness, Reber did not attend and the convention planners turned to Marston to lead a discussion on the topic of industrial education. He "kindly consented to lead the discussion, recapitulating and emphasizing the plan suggested in the March and May numbers of Iowa Factories."(49) After four years of discussions and resolutions, the 1912 convention made rather forceful statements. The resolutions on education involved a call to the State Board of Education to establish mechanic arts extension work and an appeal to the legislature to create a system of trade schools.

The first hurdle involved the Board of Regents. Prior to their meeting in November to finalize the funding
requests, a number of articles stressed the need for engineering extension. On September 24, 1912, an article, which also came out in the *Ames Evening Times* the following day, appeared in the *Iowa State Student*. It noted that Wisconsin spent $125,000 annually on trade extension work and that a similar department in Ames should assist in making Iowa State College "a great trade school and Iowa a great manufacturing state." (50) An article printed in the November *Alumnus* claimed that compared to the University of Wisconsin, the "Ames idea," promoted by Dean Marston would emulate Reber's work and "go far more thoroughly into it." (51) One hope for uniqueness lay in the expected level of cooperation of labor unions and manufacturers. Together they were to convince "the workmen that their best interest lie in a willingness to learn technically about their trades." (52) Support for these hopes came from the President of the Iowa State Federation of Labor. That man, A. L. Urick, had made many comments supporting extension work. The Board of Education knew of his position, for in its report it included reference to his views. (53) These reports and comments, while rather inaccurate, did focus attention on the proposed extension department, and when the Board met, it submitted a request in the biennial report for $50,000 for trade extension.
Perhaps more important than the request for funding was the plan for extension work included in the Board's report. This plan drew notice in several articles. The *Ames Evening Times* reported that the proposed extension department was to remedy "one of the great defects of our educational system," namely the lack of training in trades. (54) An article in the December issue of the *Iowa Engineer* quoted at length from the report. The Board's plan placed considerable responsibility on the engineering division in Ames. It proposed that the engineers establish trade schools for large numbers of youths, and begin training expert workmen and foremen. (55) The report read, "A trade school course and trade school extension courses will constitute the most effective beginning in Iowa in this sort of training...." (56) This trade school should find only temporary location in Ames, only "until it is adequately cared for in connection with the public school educational system." (57) The Board's plan placed full responsibility for developing industrial education on Iowa State College. It asserted that "in a proper system of state-wide education for Iowa," the main lines of work should "be centered under one management, and at one institution, to secure the best results." (58)

The Board's statement basically reworded Marston's
earlier recommendations. It also contained a statement by Marston on the work of the division of engineering. Taking this opportunity to further state his case, Marston argued that if a proper system of industrial education arose, the future of Iowa was rosy, since it would allow Iowa to "supplement her great agricultural development by a symmetrical development in commerce and in manufacturing." (59) In contrast to some of the newspaper articles on engineering extension, Marston indicated that he did not want to create a "central trade school" at Ames, for Iowa needed a system of many trade schools, not just one. (60) However, he did see the college of engineering as the location of administration for the nascent system of industrial education. Such a system, he asserted, needed to be centered "in one place and under one management." (61)

In addition to the strong words in Marston's and the Board's report, the pro-extension forces further propagandized their cause before the opening of the General Assembly. G. A. Wrightman, secretary of the ISMA, wrote, "The time is past due when the manufacturers of Iowa must have schools, under the supervision of the engineering
department, to train workers for them in actual trades."

James Atkinson, the editor of the agricultural journal, *Iowa Homestead*, provided support for engineering extension. His article "Education for all the People" suggested that engineering extension might hold "boundless possibilities," which could touch all towns and cities in Iowa.

Though the Iowa General Assembly opened in January, it did not consider the proposal which included engineering extension till April. During that waiting period, the spread of such programs in America received a tremendous boost through the organization of a new organization of engineers, one committed to engineering extension. While the industrial extension in Wisconsin provided an example of its potential, such programs had received limited approval in the few colleges conducting them. That situation altered rapidly in 1913 due in large measure to the influence of the Land Grant College Engineering Association, hereafter LGCEA.
LGCEA's Support for Engineering Extension

After the demise of the mechanic arts section of the AAACES, the engineering educators in land-grant institutions had no organization responsive to their unique situation. That absence led J. P. Jackson, Dean of Engineering at Pennsylvania State College, to seriously discuss the relation of the land-grant engineers and the AAACES with Edwin E. Sparks, President of the same school. Jackson felt that the engineers and agriculturalists should unite in one organization and asked President Sparks for advice on how to begin steps toward that goal. The upshot of the discussion was a letter written by Jackson to the AAACES, which Sparks hand carried to the annual convention of 1912 in Atlanta.(64)

The leaders of the AAACES did not award the request any official status, for no mention of the letter appeared in the Proceedings. Sparks, however, did get a clear two part message. First, since "the engineering interests have not take a proper interest in the Association," they were not welcome. Second, he brought the suggestion that the
best thing the engineers could do was "to get together independently...." Once the engineers had an organization, then possibly the AAACES "would be be prepared and willing to join us with them in their organization."(65) For the time being, Jackson concluded that "we do not have a right to take any part whatsoever in that Association."(66)

Jackson took the suggestion to heart and set out to initiate such an independent organization. He helped put out a call to the Presidents and Deans of Engineering in the Land Grant Colleges. With Jackson as the Chairman, the meeting began January 24, 1912 in Washington D. C., with 29 delegates representing land-grant institutions in 26 different states. Anson Marston represented Iowa State College, also agreeing to work as secretary of the impending organization.

Jackson's opening comments contained a reference to the mechanic arts section of the AAACES. "We were in it, at one time, and we thought that it was not of much account, and that the big national engineering societies were far better. We did not go to the meetings and they threw us out, and I presume we deserved to be thrown out, because we did not pay sufficient attention."(67) Professor Tyler from MIT added a bit more history of the
section. He said, "I co-operated with Professor Anderson [from Kentucky] for a time in trying to maintain a feeble vitality for the section on mechanic arts.... It seemed to me that section amounted to very little because the institutions did not send engineering men to the meetings. The engineering men found it more to their advantage probably to attend the meetings of the Society for the Promotion of Engineering Education."(68) Regardless of the perceived cause of the decline of the section, the delegates wished to renew ties with the AAACES.

This desire appeared in the first item of business, a motion that they form "a permanent organization with the object of later affiliation with the Association of Agricultural Colleges and Experiment Stations."(69) After some minor haggling about wording, this motion passed. The meeting then considered a report of a Committee on Organization, which suggested the name of the organization, its membership rules, and the following instructions: "That the executive committee be authorized to take proper steps looking towards organic relations with the AAACES."(70)

Once they had established their long term goal of rejoining the AAACES, the meeting turned to issues of immediate concern. It established ties with the Federal
Bureau of Education and discussed federal legislation, curriculum, administrative problems such as the promotion of faculty members and granting leaves of absence. The two outstanding concerns involved engineering experiment stations and engineering extension. These two topics appeared in the one and only resolution passed at the meeting. It read: "Resolved, That it is the consensus of opinion of the members of this Association that the land grant colleges through their engineering divisions should promote the advancement of the industries of their several states by (1.) The establishment of experiment stations. (2.) The encouragement of extension work in the industrial trades and professions."(71) In the discussions on extension, the participants provided a status report on the various ways engineering educators had sought to provide industrial and technical training to non-engineering students.

The appropriate relation between engineering schools and secondary schools gained considerable attention. At the time, Senator Carroll S. Page had introduced a bill to federally fund vocational education. Page had gained the support of both the NSPIE and the NAM, and many supporters expected it to pass without much opposition.(72) The prospect of federal support for vocational education had
caused Philander P. Claxton, the U. S. Commissioner of Education, to consider the role of engineering schools in guiding vocational programs. He told the gathering of engineers that he expected the Federal Government to financially aid education in agriculture, trades and industries, and home economics in schools "below college grade...."(73) He felt that if the Page Bill passed, the resulting changes would bring the land-grant engineering departments into "just as close relations with these lower schools as the Departments of Agriculture would have."(74) In other words, the engineers would provide leadership for new vocational instruction. In highly industrialized states, the engineers would, he felt, play an even bigger role in vocational education than the agriculturalists.

The delegates then discussed several possible methods to organize such a relation. One possibility had already taken shape in Wisconsin. In that state, the dean of engineering held a position as an ex officio member of the Board of Industrial Education, formally linking the college to the department of public instruction.(75) Through engineering extension, a great variety of technical courses were available to youths and adults.

In Michigan, another solution had arisen, in which no
such organic ties occurred, but considerable informal arrangements maintained a presence for the engineers in public education. G. W. Bissell, who had taught previously at Ames, represented engineering at Michigan Agricultural College. He felt the engineers should be "as nearly as possible an integral and organic part of the general education system of the State."(76) One of these informal ties involved the preparation of teachers in the engineering departments. He indicated that in Michigan "we have been in the past, and are at present, placing a number of our engineering graduates in manual training positions."(77) In his estimate, approximately ten percent of such graduates took manual training or vocational trade positions, although many of them did not intend to remain in teaching.(78)

A third possible arrangement sought to keep engineers out of the public schools. W. M. Riggs, President of Clemson Agricultural College, took that view. He wanted to severely limit the presence of the engineers in public education. He said, "I doubt very seriously the wisdom of land grant colleges invading the field of the public schools further than to furnish teachers and prepare them."(79) By implication, he opposed engineering extension, which generally sought to provide training
lacking in the public schools. For Riggs, involvement in the public schools was beyond the "proper sphere" for the engineering educators. (80)

The delegates did not come to any consensus about the appropriate involvement of the engineers in public education. They did generally agree that engineering departments needed to help prepare teachers for the public schools. However, they did appoint a committee to ascertain the "general judgment of the members of the organization as to how far we ought to go in enlarging our spheres of work, or changing them...." (81) Only Marston raised the point that engineering extension work might require a type of teacher not available among the ranks of either manual training teachers or professors of engineering.

He felt that extension work "cannot be entrusted" to the professors of engineering. Extension teachers needed to be "a very able and specially endowed body of men who can go out into the industries of the State and inspire the men engaged in those industries and enlist them in the work." (82) While Marston could not report the start of such work in Iowa, he did forcefully state his position. "I cannot think of any way in which land grant institutions
can do more good for the people of their States than to work along this line of engineering extension."(83) If monies for such work became available, he cited the first great problem would be "to find the right man to develop that work and make it a great success."(84)

Marston did have to meet the problem of finding a director for extension work, for in April the legislature approved the request for funding. That request joined appeals to continue funding for agricultural extension in House File no. 697. It first came to the floor on April 8, and at that time included the sum of $50,000 for engineering extension.(85) It went then to the Appropriations Committee, which reduced the amount to $25,000. On April 23, 1913, it received final approval.(86)

Even though the amount requested had been slashed, the legislative action appeared a great victory to the supporters of industrial education. Raymond Pearson, President of Iowa State felt the two year trades course offered all ambitious young men "a chance to become more efficient in their vocation."(87) G. A. Wrightman considered the funding a turning point in the development of Iowa State, for he claimed that the college was to
become "a pioneer in the line of industrial education as she has been in agricultural education."(88) The most lavish praise came from the ISMA, for it cited the funding as "easily the greatest work of the Thirty-Fifth General Assembly," which was to begin a new educational era. Instead of following an outmoded notion "that saw a curse in labor, a blessing in indolence," under the new system, Iowans were to "do what our forefathers neglected — educate our boys toward work, not away from work."(89) With the funds assured, Marston set out to build an extension department that could begin work for the fall of 1913.

Summary

The road to this funding began with the agitation of the ISMA for industrial education. It initially did not see engineering extension as the method to build such education. However, the YMCA demonstrated that many young engineers had a deep concern for the education of American working men and youths. Engineering students in Ames joined the industrial service work and provided Marston with an example of the potential role engineers could exercise in vocational education. Marston joined forces with the ISMA in 1912 and transformed its concern into support for engineering extension in Ames. The Board of
Education took up Marston's recommendations but before the legislature considered the request, Marston participated in the forming of the Land Grant College Engineering Association. That organization provided a sense of credibility to the concept of engineering extension, which in 1912 existed as a developed educational form only in Wisconsin. These factors together created a formidable support for engineering extension.

Once the funding came through, Marston turned to the only group experienced in engineering extension, Reber's staff in Madison. In that group, he selected K. G. Smith to head the new department, and J. Will Parry to assist Smith. In so doing, he brought into Iowa the general philosophy and several specific organizational techniques worked out in Madison.


3. Ibid., p. 35. Gray's dissertation provided great detail on the support of NAM in the campaign to pass the Smith-Hughes Act.

4. "Paul Arbenz is Made President," *Ottumwa Courier*, 5 June 1908, p. 3.

5. Ibid.

6. Ibid.
7. "Dillon Turney President of Manufacturers," The Democrat and Leader, Davenport, Iowa, 10 June 1909, p. 10.

8. Ibid.

9. Minutes of the Iowa State College Faculty Meetings, 23 May 1910. [ISU Archives]

10. Ibid., 24 May 1910. [ISU Archives]


15. Anson Marston in discussion, Proceedings of the


17. Charles R. Towson, "The Industrial Outreach of the Y.M.C.A.", The Survey 29(16) (18 January 1913):527. This type of education for immigrants was not limited to the YMCA. In Detroit, Henry Ford created an Americanization movement among his employees. In 1915, both the Detroit Americanization Committee and the National Americanization Committee formed. For more details, see Olivier Zunz, The Changing Face of Inequality (Chicago: University of Chicago Press, 1982), pp. 312-318.


20. Fred H. Rindge, Jr., "Industrial Service Movement
of the Y.M.C.A.," The Survey 30(3) (19 April 1913):104.

21. Rindge, "Industrial Service Movement of the

22. Towson, "The Industrial Outreach of the

23. Fred H. Rindge, Jr., "The Engineer and the

24. Ibid., p. 269.

25. Ibid., p. 275.


27. Ibid., p. 275.

28. Rindge, "Industrial Service Movement of the

29. L. H. Barker, "Industrial Service Work at Iowa


34. Ibid., (March 1912):20.

35. Ibid., (May 1912):5.

9, June 1912).


38. Ibid., p. 9.


41. The following names found in Directory of Engineering Alumni of Iowa State College (ISC: Iowa Engineer, 1 January 1938).

Dean C. Simpson, B.M.E 1903, Instructor Edison Technical High School, Fresno, California.

Charles L. Tibbetts, B.S. E.E. 1903 Wood Instructor, Santa Ana High School, Santa Ana, California.

Robert S. Goulden, B.M.E. 1906, Teacher, Atlanta, Georgia.


R.F. Van Deventer, B.S. E.E. 1908, Industrial Arts, Evanston
Township High School, Evanston, Illinois.


Claron B. Hutchison, B.S.E.E. 1913, Electricity Instructor, Public Schools, St. Louis, Missouri.

David R. Scott, B.S. E.E. 1914, Industrial Arts instructor, Omaha, Nebraska.


Earl H. Kimball, B.S. M.E. 1916, Director of Vocational Education, Waterloo, Iowa.

Ray F. DeForest, B.S. A.E. 1919, Instructor at Automotive Trades School, Cincinnati, Ohio.

42. *Iowa State College Catalogues*, 1904-1909.


45. Ibid.
46. Ibid.


48. Ibid., p. 35.


52. Ibid., p. 25.


56. Ibid., p. 152.


60. Ibid., p. 338.

61. Ibid.


64. J. P. Jackson in discussion, Proceedings of the Organization Meeting of the Land Grant College Engineering Organization, [LGCEA] p. 10

65. Ibid.

66. Ibid.

67. Ibid., p. 5.


70. Ibid., p. 19.

71. Proceedings LGCEA, p. 75.

the efforts culminating in the Smith-Hughes Act.

73. Philander P. Claxton in discussion, Proceedings LGCEA, p. 25.

74. Ibid., p. 27.

75. G. W. Bissell in discussion, Proceedings LGCEA, p. 50.

76. Ibid., p. 51.

77. Ibid., p. 50.

78. Ibid., p. 51.

79. W. M. Riggs in discussion, Proceedings LGCEA, p. 52.

80. Ibid.

81. Proceedings LGCEA, p. 53.

82. Anson Marston in discussion, ibid., p. 46.
83. Ibid., p. 30.

84. Ibid., p. 46.


86. Acts and Joint Resolutions Passed at the Regular Session of the Thirty-Fifth General Assembly of the State of Iowa (Des Moines, Robert Henderson, State Printer, 1913), chapter 228, p. 252.

87. R. A. Pearson in "College Extends its Instruction; Any Young Man or Young Woman with Public School Training Can Enter," Iowa State Student 38(64) (17 May 1913): 7


CHAPTER 5:
THE FIRST YEAR OF ENGINEERING EXTENSION IN IOWA, 1913-1914

Soon after the legislature approved funding for engineering extension, Marston began to lay plans for recruiting its staff. Perhaps he had even previously begun unofficial search for a director. On July 15, a faculty committee received authority to appoint a professor of engineering extension, and by the end of July, Kenneth G. Smith had been recommended for the position. This two week search time indicated that the supporters of extension likely had a candidate already in mind. Besides, there existed very few sources for men experienced in engineering extension work.

Before Smith took the job in Wisconsin with Reber, he had already accumulated experience in mechanical engineering. After graduating from the University of Illinois, he worked for a steam engine company in Newark, New Jersey and served as shop superintendent with the
Westinghouse machine company in East Pittsburgh and the Kerr Turbine Company of Wellesville, New York. While many mechanical engineers had similar backgrounds, few had gained any expertise in extension work.

Smith had unique qualifications. Working in Milwaukee, he saw first hand the problems extension instructors faced when trying to teach both experienced working men and youths. He held several positions within the extension division in Madison, thus gaining exposure to various levels of administrative work. Also, he had begun what was to be a prolific writing career.

In 1912, he and Earle B. Norris, an assistant professor of mechanical engineering at Madison who had charge of the mechanical engineering courses in the extension division, authored a book, Shop Mathematics. That book had as its goal teaching "the fundamental principles of mathematics to shop men...." As indicated in the preface to the book, Smith conferred with Fred D. Crawshaw of the Manual Training Department, to benefit from Crawshaw's expertise in teaching methods.

Yet another qualification lay in Smith participation in an organization of secondary school teachers, the
Central Association of Science and Mathematics Teachers, hereafter the CASMT. That organization grew out of the merger of the Central Association of Physics Teachers and the Mathematics Section of the Educational Conference of Academics and High Schools. Those groups sought to promote improvements in teaching, curriculum and relations with colleges. That principally involved sponsoring research and publications on teaching methods and evaluation. To better coordinate their work, the two groups merged in 1903. By 1907, the organization had drawn over 500 members from 14 states and contained sections on biology, chemistry, earth science, mathematics and physics.

At the 11th annual convention, held in Chicago on December 1 and 2, 1911, Kenneth G. Smith presented a paper in meetings of the mathematics section. His paper, "The Application of Mathematics to Problems of the Shop," referred to the Wisconsin extension department and indicated that teaching shop math was difficult. "To select problems, to make them practical and to relate them to the things with which the apprentice or workman is familiar, is not easy and here is where ingenuity, knowledge, and shop experience are required on the part of the teacher." Smith concluded his paper with a list of eight general principles which should, in his opinion,
govern the application of all mathematics to the shop. By following his principles, teachers of shop math should achieve better results. A successful industrial teacher, according to Smith, deserved considerable acclaim, for such a person "may count himself as one who is assisting in the industrial progress of this nation as truly as the engineer who designs a locomotive or spans a chasm with a bridge." (7)

Smith accepted the position as Professor of engineering extension, at a salary of $3200 per year, a sizable salary. (8) According to the 1913-14 budget, R. K. Bliss, the director of agricultural extension earned $200 less than Smith, while W. H. Meeker, the head of mechanical engineering received $300 less than Smith. (9) Smith came into a situation in Iowa, which already had partial guidelines provided in the legislative act funding the extension department. Beyond this general direction for the work, Smith had the responsibility for formulating specific plans to carry out engineering extension. He relied directly and indirectly on Reber's division, later writing, "The vision seen, the experience gained, the plans formulated, the courses written, aye, and the mistakes made, while a member of that organization are proving valuable assets...." (10)
From the start in Iowa, Smith worked to build extension along five lines: correspondence instruction; a trade school on the campus at Ames; technical lectures; short courses; and classes in industrial centers. Such a diverse program would require staff members with widely varying talents. Even before he left Wisconsin, Smith began recruiting men to fill those positions.

He brought with him from Wisconsin J. Will Parry, who had also been in the engineering extension work at Madison.(11) Parry moved to Ames to take the position as secretary and associate professor of engineering extension, for which he received $2,000 in the 1914-15 year.(12) The other three original staff members did not come from Madison.

In early September, R. B. Dale and Edwin S. Shortess joined the staff, Dale as instructor at $1800 per year, and Shortess as field organizer at $1500.(13) These salaries fell slightly lower than those for men in comparable positions in agricultural extension.(14) Dale came from the College of Applied Science at the State University of Iowa, where he served as instructor in the department of descriptive geometry and drawing. He held that position
for three years, earning $1500 in his last year there.\(^{(15)}\)

He probably came to the attention of Smith through his writing, for in 1911 and 1912 he published several articles and at least half a dozen letters to the editor.\(^{(16)}\)

Shortess had traveled to the Philippine Islands while in military service and stayed for 14 years.\(^{(17)}\) During those years, he worked as a teacher and newspaperman and gained experience in school administration.\(^{(18)}\) The fifth full-time member of the staff, O. H. Johnson, a teacher from River Falls, Wisconsin, did not join them till the end of October, when he accepted an appointment as an instructor at a salary of $1500 per year.\(^{(19)}\)

**Correspondence Instruction**

The correspondence work fell on R. B. Dale who planned to create two distinct instructional levels. One level was to provide instruction "for students who are prepared for work of college grade in engineering," and the other level for workingmen.\(^{(20)}\) The upper level should include courses on structures, steam boilers, heat, drafting room practice, heat and ventilation, mechanics, DC machinery, electric meters, agricultural engineering and ceramics. The lower level planned elementary and advanced shop math, builder's
estimating, elementary and advanced shop drawing, and specialized drawing for builders and carpenters. In addition, he projected courses in business engineering, such as retail selling and store management, elementary and advanced cost accounting and plant management.(21)

Dale could not hope to personally organize, write and publish all the correspondence materials needed, and did rely on many courses prepared in Madison. In fact, the shop drawing courses used for the first two years came from Madison.(22) However, he did work up lessons on mathematics for carpenters and builders. The first section of this course, to be followed with a more advanced course, came into use in February, 1914.(23) Even before its completion, Dale received requests from the supervisors of manual training in the Des Moines schools, and also from as far away as Pennsylvania State College.(24) The specific motivation for this work stemmed from a survey, perhaps conducted by organizations of builders, which indicated that the total number of Iowans employed in the building trades far outranked other crafts.(25) As Dale worked on the material, he submitted outlines for the approval of the Iowa State Building Trades council and the Brotherhood of Carpenters and Joiners. Once complete, correspondence students used the course and the Des Moines public schools
introduced it into their apprentice training and
continuation work.(26)

The correspondence courses functioned at various
academic levels. Some students took them for the purpose
of personal development, others used the courses to make up
college entrance requirements, while yet another group
earned college credit by completion of courses. The last
group even included one physician in Dubuque who received
credit for a mathematics course.(27) A few students in the
new two year engineering curriculum entered in the second
semester and used correspondence work to catch up on a
portion of the work they missed.(28) During February, the
enrollment in correspondence work numbered 225, 13 of whom
were students in the two year courses, and 32 making up
entrance requirements.(29)

Late in May, 1914, Dale submitted a report to Smith
summarizing the correspondence work. He listed 230
students in correspondence work, the vast majority of them
from the cities in which local courses had attracted
students.(30) By the year's end, 29 students received
certificates for completed courses, 44 did satisfactory
work, and 42 had dropped out. The remaining students had
not completed the work, but would likely continue the
Some students sought either entrance or advanced credit for the correspondence work, but they had to meet a number of criteria to receive credit. These rules provided a minimum standard, which although differing from a high school diploma did require a similar level of education. Though the awarding of college credit for correspondence work raised a few questions, even more concern followed in the beginning of the trade school, also known as the two year course in engineering.

Trade School

As early as May 1913, one month after approval of funding, the faculty committee on course of study recommended the entrance requirements for the two year trade school be identical to those for the two year agriculture courses. That meant that young men who had completed at least the 8th grade in public schools might attend. Fifteen such students began the fall term, under the care of both Smith and Dale. Though those two men provided the bulk of instruction, eight other instructors, all working only a few hours, provided classes and tutorials in English, mathematics, and chemistry.
the beginning, the two year students received instruction in the shops of the mechanical engineering department, for the extension budget did not permit the establishment of new shop facilities. (35)

The trade school work on the campus was to differ sharply from the four year engineering work, "even in the fundamentals of mathematics and drawing," for that training was to be "more directly practical" and not a foundation for collegiate work. (36) The two year work included four lines: structural designing and building maintenance; surveying and road making; electricity and stationary engineering; and mechanical drafting and machinery. (37) In the middle of the school year, the extension staff tried to include a new course, one for building superintendents. (38) This attempt did not lead to a permanent change, for by the end of the school year, this course for janitors had disappeared from the listing. (39) By June, 1914, 50 students had participated in the trade school work, only 15 in the two year work and the others making up entrance credits to the four year work. (40) For those 35 students, the trade school served as a source of remedial education.

Just as the curriculum displayed some instability, the academic boundaries for the program also moved considerably
during its first year. In late November, Smith wrote a letter to Marston requesting a temporary shift in the policies which separated the two year work from four year engineering. He asked that the two year students receive permission to choose some regular college courses as their electives, even though they had not meet the college entrance requirements. Smith got that wish and in December joined a committee to study the feasibility of organizing the sub-collegiate work into three terms, so as to accommodate those students who could attend only during the winter months. However, the committee, composed of Smith, Dean Curtiss and Dean McKay, decided in February against replacing the semester system with quarters. Also in February, Smith announced that the two year courses had gained a new option, making it possible for a student to complete the two years work with only one year in residence at Ames and another year of correspondence work.

After the completion of the first year, Smith pushed again for exceptions to the entrance requirements for the two year trade school. In July, he asked for expansion both down, to allow some students without an 8th grade certificate entrance, and up, to allow high school graduates matriculation. The previous policy had been
that high school graduates should enter the four year engineering work. Smith wished to challenge the rule because a graduate of Monticello High School wanted to enter the two year work. The ruling of the Board of Deans required Smith to submit any cases involving high school graduates to their consideration, but that if a student could demonstrate an education equivalent to 8th grade level, he might enter.(46)

Thus, before the start of the second year of the trade school work, Smith had achieved considerable bending of the rules. Some students without 8th grade certificates, and some high school graduates could enter the trade school. Some trade school students also gained entrance into the regular college courses. He had to some degree blurred the lines separating the two year students from those in the four year course. These changes in conjunction with the potential of college credit or entrance credit through correspondence offered a path into higher education for some young men in Iowa shops and factories who had "found themselves barred from college engineering courses by lack of specified entrance requirements."(47)
Technical Lectures

All the extension staff participated in supplying technical lectures on various engineering topics. However, the interest in automobiles warranted the full time efforts of one person, so in late November, R. E. Davis, who earned his bachelor's degree in mechanical engineering at Iowa State in 1910, took the appointment as special lecturer. Davis had previously worked for the Packard Motor Car Company in Detroit, and the Fal Motor Car Company in Chicago. He did not receive a year long contract, but took a 6 month job, at $175 per month.

Davis prepared a number of lectures on the care and maintenance of automobiles and developed them into programs called automobile institutes. These institutes lasted either three or five days, with the first one occurring February 2, in Alden, Iowa. In February, he also traveled to seven other towns, presenting his institutes to enthusiastic crowds. According to one estimate made in January, 1914, approximately 25,000 Iowans were to be reached by the institutes in early 1914. That guess
came very close to the actual figures, for a report prepared by J. Will Parry on the basis of information supplied by Davis listed the total attendance at 3000. \(^{(53)}\)

In all, 27 towns and cities hosted institutes, generally under the sponsorship of commercial clubs and auto and good roads clubs. \(^{(54)}\) At these various locations, Davis delivered his lectures and also inspected a number of cars. He gave advice and made adjustments on over 300 cars during the institutes. \(^{(55)}\)

Beside the automobile institutes, which formed the bulk of the technical lectures, both Smith and Dale presented talks. Dale lectured in various towns on printing and engraving, while Smith concentrated on industrial safety. \(^{(56)}\) In January, Smith presented three films he had received from the National Association of Manufacturers at a meeting of the civil engineers society. These films, which treated industrial safety, fire protection, and the importance of education, had drawn large audiences in several midwestern cities. Approximately 50,000 saw them in Milwaukee, and they also drew a crowd at the social center in Des Moines. \(^{(57)}\) The NAM had prepared not only the films, but also a slide series on safety devices. In March, Smith acquired these slides, which came from the NAM Committee for Accident
Prevention and Workmen's Compensation, and conducted presentations based on the slides. He asserted that the extension department "will be glad to furnish these slides and a lecturer anywhere in the state simply for expenses." Through these and similar programs, the extension department hoped to cooperate with the ISMA and the Iowa Department of Labor in "a great movement...to provide safer and better conditions for the workingman." (58)

When Smith summarized the attendance at these lectures, he included figures for the viewers of the motion pictures, which contributed heavily to the total of 7420. (59) A rather unique audience included in that total numbered 600 inmates at the penitentary in Fort Madison, to whom Smith presented a lecture on locomotives in April, 1914. In addition to the various lectures, he listed the conventions he and J. Will Parry addressed, bringing the grand total reached by technical lectures, not including automobile institutes, to 7920 Iowans. (60)

Short Courses

The agriculture department in Ames had established a tradition of conducting short courses during the Christmas
vacation. That timing eased the housing situation, for with the students gone, the participants could find adequate supply of rooms. The extension staff chose to follow the same schedule and in September published plans for a short course in Highway Engineering, which was to run under the auspices of the Highway Commission. Later they also indicated proposed courses for clay workers, cement users, road builders, and hoped to include instruction in gas and steam engines, tractors, power plants and the application of electricity. (61)

The course for highway engineers differed from most of the other short courses developed in Ames in that it drew not industrial workers but specialized, highly trained engineers. The instructors were not engineers functioning as vocational educators, but engineers who were "specialists in their line and who are actively associated with Highway Engineering practice and who are of the highest reputation...." (62) The participants in that course, who held positions as county engineers, city engineers and superintendents of highway construction, met in Ames between December 29 and January 9.

While the course for highway engineers meet with success, the attempts to draw industrial workers to the
engineering short courses generally failed. The extension staff worked to advertise the courses, mailing out fliers, and guaranteeing the inclusion of engineering courses in general write-ups on the winter short courses.\(^{(63)}\) They hoped to fulfill two functions, first to keep the participants abreast of current technological developments, and second to provide technical information in a definite, systematic manner, thereby providing for tradesmen a source of knowledge superior to that available in trade and engineering journals.\(^{(64)}\)

Between December 29, 1913 and January 9 1914, they conducted 10 courses, one each in clay working, cement use, road making, drainage, application of electricity, steam engines, tractors, gas engines, automobiles, and power plants.\(^{(65)}\) The courses ranged in length from the longest of 10 hours classroom and 20 hours of laboratory work to the shortest with two hours of lecture. A total of 51 students participated, the majority of whom were farmers, not industrial workers.\(^{(66)}\) However, the numbers enrolled did not accurately portray the actual conduct of the courses. The course in clay working, which drew no participants from clayworking companies, did not continue to the end of the planned sessions. The lectures on electricity, for which 31 signed up, drew only three or
four near the end. J. Will Parry, who prepared the report on these courses, concluded that the course as given was "not feasible." (67) He suggested that in the future the courses should "be of direct interest to the farmer," and include work on farm lighting, the use of cement on the farm, and other classes directly related to agriculture. (68)

In contrast to this rather dismal showing, the short course for painters and decorators achieved considerable notice and largely set the direction for the development of the engineering short courses in Ames. Impetus for that course came from Fred M. Michael, a resident of Marshalltown and the President of the Brotherhood of Painters and Decorators. (69) He worked with the extension staff to organize two activities for painters, the annual convention of the Iowa Master Painters and Decorators and the short course. He helped schedule the convention to coincide with the short course, for it occurred in Ames on January 5 and 6, just preceding the short course, which ran from January 6 through 9.

The convention featured a number of prominent speakers including A. L. Urick, the Iowa State Commissioner of Labor, State Senator A. B. Ames, E. H. Cunningham, Speaker
of the Iowa House of Representatives, E. P. Schoentgen, member of the State Board of Education, Anson Marston, and Iowa State College President R. A. Pearson. This lineup of speakers reflected the importance attached to the efforts of the painters' organizations to sponsor educational programs for their members. Senator Ames claimed that the painters and decorators had started a movement which marked "the beginnings of a new era in industrial education in Iowa." Both Urick and Cunningham used their speeches to promote the cause of industrial education in the public schools. Cunningham proposed that a trade school education should "be compulsory in Iowa between the ages of 14 and 18." Urick also spoke about the numbers of young people who left school after 8th grade, saying it was "the duty of the state to teach them a useful trade or occupation in order that they not become unfit and charges to society in later life." Though they stressed the need for industrial education in the public schools, they felt no contradiction between such support and aid for engineering extension. Urick, Ames, and Schoentgen planned "to organize a trade school and aid the trade school extension work under the direction of Prof. K. G. Smith."

On the heels of the convention and its lofty plans,
the short course also found success. By way of advertisement, the extension staff printed 3000 copies of an announcement which listed instruction in stenciling, blending, sign painting, and graining. (75) In early December, J. Will Parry traveled to Chicago and succeeded in hiring Charles Mollendorf from the Chicago School of Painting, Decorating and Paper Hanging to teach stenciling, blending and sign painting. (76) As it turned out, Mollendorf had little interest in signpainting, consequently providing almost no instruction in this area. (77) An additional instructor joined Mollendorf, J. W. Luthe from Cleveland, who taught graining. (78)

The extension staff expected about 30 painters and decorators, but 57 men enrolled in the course. (79) Almost all the men had considerable experience and held the rank of master painter or journeyman painter. At the time, the painters' organizations conducted no uniform systems of apprenticeship, consequently the average journeyman was "largely self taught." (80) Besides the lack of formal apprenticeship, those painters desiring training in the more complex decorating tasks had no convenient opportunities. Painters had to travel to Chicago, St. Louis or Pittsburgh to find adequate schools. (81) The timing of the convention to just precede the short course
also helped spread the word, with the consequence that the quarters assigned for the course were congested.

The courses took place in the engineering annex, and the participants did not hesitate to alter the walls in the rooms. One report called the walls "particularly gaudy since vacation," for the painters had tried out a number of colors and patterns.(82) The room used by civil engineering students for drawing instruction contained a number of square pillars, each of which sported a different pattern and color scheme on each side.

The course met with such success and positive response from the participants that the extension staff began to plan a course for the following year. In fact, a report on the course claimed that it "should become an established institution," which could draw on the 9 to 10 thousand painters in Iowa for many years.(83) The staff expected the enrollment to jump to about 150 men and hoped to use walls both in various office rooms and in the barracks occupied by the chemistry laboratory for exercises.(84) As the first course, the second was also to appeal to experienced painters. However, the Master Painters Association wanted training for those beginning their trade. That would entail a longer course similar to those
available in Chicago and St. Louis. The extension staff figured that the second course might provide "the proper impetus for the establishment of a regular three or four months course in residence."(85)

Although the hope of creating an additional course in the trade school led to no immediate changes, the first short course provided the model for other courses. The painters' course stood as an example of a type of course "which can be given successfully and profitably to industrial workers."(86) It brought to the workers, in this case painters, both increased manual skill and potential increases in earnings. In this manner, the extension department fulfilled its service mission, both educating and enhancing the earning power of the participants.

Teacher Training

In addition to the winter vacation programs, the department also conducted another type of short course, one for teachers. The motivation for this work came from a new law passed in March, 1913, by the Thirty-Fifth General Assembly of the State of Iowa. That law required the
teaching of elementary agriculture, domestic science, and manual training in public schools starting no later than July 1, 1915. (87) This law created such a demand for teachers of agriculture and manual training that the Superintendent of Public Instruction cited this insufficiency in his Report in 1914. (88) The extension department tried to provide special instruction for teachers to qualify them for new manual training positions by organizing short courses. Such courses first began in March 1914, for an article dated March 10th identified instruction for manual training teachers as "the last step" taken by the extension department. (89) Smith's report written in June 1914 identified March 1 through June 13 as the period in which manual training instruction occurred. (90)

The manual training work fell to O. H. Johnson, who traveled over the state conducting the short courses. He delivered 10 institutes, each lasting one week in various towns. (91) In some cases, he traveled with R. K. Ferrar from agricultural extension and Miss Phelps from the home economics department. (92) Together they trained teachers in rural school districts. When this team went into a county, the teachers often found substitutes or cancelled classes to attend a session which lasted six days.
Counting agriculture, home economics and manual training teachers together, a rough average attendance was about 125 teachers per county.(93)

Smith did not welcome the manual training work with open arms. In his report, he indicated that during the fall of 1913, the extension staff members "were informed that manual training was to be a part of the Engineering Extension work."(94) This imposition forced Smith to utilize O. H. Johnson in both industrial classes and manual training, for he did not have the funds to hire someone specifically prepared to train teachers. Smith felt some conflict between the other aspects of engineering extension and the teacher training work. He advised Pearson and Marston that the department needed a specialist in manual training to make the work "a thorough success." The partial success of the first efforts stemmed from the differences between industrial work and manual training. "A man fitted to handle industrial work is not of the type to be most successful in manual training, and a manual training teacher is not adapted to industrial work."(95) Under the circumstances, O. H. Johnson had done good work, but Johnson's strength lay in industrial work.

Despite Smith reservations about the manual training
work, the need for vocational teachers became so severe it placed even more pressure on the extension department to train teachers. Albert M. Deyoe, the Superintendent of Public Instruction, sent a letter to R. A. Pearson concerning the dearth of manual training teachers, asserting that the "special need in both the consolidated schools and the normal training high school is for teachers of agriculture and manual training."(96) Besides the short courses, the engineering extension staff also considered the possibility of increasing their efforts by providing instruction in manual training both during the winter short course and as part of the correspondence courses.(97) However small, these first efforts in teacher retraining began the involvement of the extension department in the preparation of manual training and manual arts teachers. This work later grew, involving increasing amounts of the attention of the extension staff. After World War I, the teacher training work split off from the extension department, becoming the mission of a new department of Trades and Industries.
Local Classes

The biggest and most acclaimed line of work occurred in many cities in which the extension department established local classes for workingmen, similar to those run in Wisconsin. Smith devoted considerable time during his first few months as leader of engineering extension to the organization of these classes. In September, he traveled to a number of the larger Iowa cities, stopping first in Cedar Rapids. He met there with representatives from trade unions and manufacturers and succeeded in getting their support for the initiation of night classes.(98)

While Smith helped start the local classes, the responsibility for maintaining and extending the work lay with Edwin Shortess, the field organizer. That meant he helped initiate classes in new locations and provided assistance to already established centers. In practice, Shortess travelled all over Iowa, explaining the goals of
engineering extension to business and educational leaders, and seeking their assistance. By Spring 1914, he had visited 49 cities and towns, conferred with 23 school superintendents, 39 leaders of commercial clubs, 17 YMCA officials, and members of about 60 other organizations. (99) In the larger cities, he visited industrial companies, frequently delivering a short speech to the employees, so that during the first year he addressed about 3500 people. (100) When he found groups or individuals who wished to cooperate with the extension programs, he followed up, hoping to initiate local classes.

The first local class organized in Cedar Rapids and since it appeared that the response from local workingmen would require a number of classes, Smith and Shortess searched for a local instructor, who would work under the guidance of the extension staff. Not surprisingly, they selected as instructor an engineer who received his training at Iowa State. This man, Arlo A. Soth, who graduated from the mechanical engineering curriculum in 1910, worked as a mechanical draftsman for the Krit Motor Car Company in Detroit, and later for Deming Motor Implements Company in Cedar Rapids. (101) Selecting an alumnus offered Smith the opportunity of gathering estimates of his worth as a teacher from his previous
professors and also provided a direct tie to industrial managers in Cedar Rapids. Soth taught classes four nights per week, each class running for a 20 week term, receiving a compensation of $2.50 per evening. (102) The classes he taught, which he held in the YMCA, covered several topics, shop mathematics, gasoline engines, and heating and ventilation. (103)

The classes in Cedar Rapids got off to a good start, and on November 7, 1913, representatives from labor unions, the public schools, and local manufacturers met with Smith "to work out a basis for further extension of industrial education in that city." (104) Smith felt that the meeting helped create a "triangle of co-operation," which should "insure the success of engineering extension in Cedar Rapids." (105) In the event that the classes outgrew the rooms at the YMCA, the auditorium room of the public library stood available to Smith for extension activities. The courses in Cedar Rapids succeeded in attracting working men from a number of trades and several industries. One class in mechanical drawing and shop math illustrated this spectrum, for the students included 11 machinists, 5 tinners and sheet metal workers, one woodworker, and 4 clerks and office workers. They represented a number of small companies and two larger companies, the Denning
As in Cedar Rapids, extensions courses sprang up in Waterloo, Marshalltown, Charles City and Mason City. Local instructors taught the classes, but they received close supervision from the extension staff. The work in Waterloo grew to the size that it required more time than the local instructor, W. D. Johnston, could provide, so to assist him, O. H. Johnson moved to Waterloo by December, 1913. Beside conducting the extension classes in Waterloo and maintaining a local extension office, Johnson gave lectures in various high schools. These lectures tried to interest high school students in various occupations and to point out "opportunities for securing a better education and one that will fit him for his life work." (108)

In Marshalltown, two companies, D. D. Durham Company and Lennox Furnace Company, requested the extension department to organize classes. The local instructor for these classes, F. E. Schmidt, also had direct ties to the engineers in Ames. He had earned a degree in mechanical engineering at Iowa State College, graduating in 1913.

In Charles City, the local school board collected a
small tuition from students to help pay the wages for Albert R. Squyer, chief melter in the foundry of the Hart-Parr Company, who ran the local classes. (109) Although he had entered the engineering department in Ames in the fall of 1908, remaining more than three school years, he earned no degree. (110) He apparently began his senior year, but did not complete it, for he never graduated. Probably due to his influence, the Hart-Parr Company gave its employees a vacation from December 29 to January 5 and expected a number of its employees to go to Ames to attend the winter short courses. (111)

In contrast to the tendency to hire ex-engineering students, Mason City had instructors, L. S. Pickford and Arthur Felt, who held no direct ties to the engineering department in Ames. However, Pickford worked for the largest heating and plumbing company in Mason City, having therefore considerable knowledge of the course he taught. (112) The local classes in Des Moines also did not utilize a student from Ames. They began under the guidance of C. E. Partch, who later became the Dean of the School of Education at Rutgers University. (113)

By the end of the first year, the local classes had enrolled 250 students, 230 in the industrial classes and 20
in one class on retail selling. (114) The drop-out rate ran rather high, with only 32 per cent completing the courses they began. (115) Despite the high number of drop-outs, Smith considered the work a great success and indicated that nine other cities planned to join extension work the following year. (116)

Near the end of the first year of engineering extension, a new program joined its repertoire. In May, 1914, J. Will Parry announced the Engineering Service Bureau, which combined the expertise of the engineering experiment station and the extension staff. It planned to assist Iowa industries, particularly the small ones, in solving a wide range of technical problems. Parry felt this bureau would take no work away from consulting engineers, because in his estimation, "95 per cent of the bothersome questions of a technical nature which come up are not of importance enough to demand the services of a consulting engineer." (117) Not only could the college provide a needed service in solutions for these small problems, it could attack the problems with the combined power of the experiment station and the extension experts. That group represented a group of experts "much broader in scope and much more specialized in the many technical lines of present day industry than any one organization is able
To support." (118) To utilize this service, local industries needed only to write a letter describing the difficulty. If the problem required further analysis, the bureau would send out a man from extension or the experiment station to inspect it on the site.

The first year of extension led to its active participation in short courses, local classes, a two year trade program, correspondence instruction, and minor efforts on an engineering service bureau, instruction for teachers of manual training, and courses for prisoners. Smith figured that in all, the extension department had directly reached more than 18,000 people during its first year. (119) These established programs represented only a beginning, for according to Edwin Shortess, many other areas needed extension programs. He felt expansion feasible in retail salesmanship and store management, auto repair, plumbing and sheetmetal work. He also had been in contact with the Tri-City Master Builders Association and the Tri-City Carpenters District council, organizations serving Davenport, Rock Island, and Moline. (120) Shortess felt the extension department could assist these organizations in the classroom instruction they required during apprenticeship. By working out some arrangement with these and other organizations, the extension
department, he asserted, "would be doing the trades of the state unlimited service." (121)

Smith understood the activities started in the first year as a beginning, not only meaning that the program was young, but also functioning at an elementary level. Anticipating some criticism, he wrote, "No doubt someone will say that the above results (of extension) are the results of industrial education, not of engineering extension." However, the basic knowledge presented in the first extension attempts stood as prerequisite to the more advanced levels. The immediate task, according to Smith, centered on the interpretation of engineering data for the working man. "Isn’t it about time we cease to sprinkle all our technical instruction over the top and begin to pump some up from the bottom? When we do, there will be some results in engineering extension proper as well as in industrial education." (122)

Professional Organizations

Although the first year of engineering extension required tremendous organizational effort, the staff did not spend all its time developing the program. Smith took
time to attend meetings of a number of professional organizations. In October, 1913, he traveled to Grand Rapids, Michigan to attend an annual meeting of the NSPIE. (123) Smith also attended coventions of the ISMA, the State Teachers Association, and the State Federation of Labor. (124) J. Will Parry went to conventions of the Master Builders, Electrical Contractors, the State Telephone Association, and the Stationary Engineers. Perhaps the one meeting most significantly impacting on engineering extension was the second annual meeting of the Land Grant College Engineering Association.

The LGCEA met in Washington D. C., November 11-14, 1913, and set out to define the term mechanic arts with the intention of clarifying the purposes of their organization. The outbreak of war in Europe caused inclusion of papers and discussions of military activities at land grant colleges, but the bulk of the session concerned experiment stations and engineering extension. Smith as director of industrial extension in Iowa joined Reber and Norris as presenters of papers. Reber's paper was a summary of the engineering extension work in state colleges and universities, amounting to a listing of activities. Norris gave a paper "Engineering Extension", reviewing in quite thorough detail the work in Wisconsin. He made the
position of the extension work in the larger plan in Wisconsin clear, indicating that extension had found "a permanent place in the educational system of the state." Although after the development of the state system for industrial education, the public schools took over many of the programs initiated through extension, it was not in danger of extinction. The public schools were to "serve as natural feeders to the extension courses. They will conduct the more elementary class work, and awaken a desire for further instruction."(125)

The discussion following Reber's and Norris' papers contained the beginnings of a conflict which became central one year later. Dean Benjamin of Indiana represented a view opposed to the enlargement of extension activities into the realm of vocational education. He stated, "To my mind it must be differentiated once for all from vocational secondary work of every description, from trade schools, night schools, correspondence schools, continuation schools, etc., etc."(126) Benjamin wanted extension to keep out of sub-collegiate and secondary work, for in his opinion, "the college loses dignity and caste by stooping to kindergarten and trade school methods."(127)

Behind Benjamin's comments lay a notion that a
university ought to provide thorough training for a restricted number of leaders in business, science, and the arts. This view directly conflicted with the approach of those furthering engineering extension, for they claimed to serve industry through education of its employer and foremen. Apparently, the supporters of extension had not prepared their case, for no one gave adequate rebuttal to Benjamin's attacks. The following speakers did not take up the argument, but chose to report on their extension programs. R. L. Wales and Francis C. Shenehon, Deans of Engineering in Minnesota and Rhode Island, discussed the beginning steps they had taken in the preceding year. In contrast to Benjamin's view, Wales felt that extension "will be a great benefit to our institution." The same opinion appeared in a paper, "College Engineering Extension at Iowa State College," prepared by Smith but presented in his absence by Charles S. Nichols, the assistant to Dean Marston.

Smith had long since come to the conclusion that extension programs of varying academic levels belonged to the universities. His paper reviewed the activities in Iowa, in some cases including, word for word, several paragraphs taken from his report in the October issue of The Alumnus. While the philosophy of extension gained
little attention in his paper, he did voice his basic position. He maintained that a state educational institution fulfilled its objectives in the area of engineering and industrial subjects "only in so far as it comprehends and meets the needs of the industries of the state...."(131) For Smith, extension should stoop to kindergarten methods if the industrial workers in a state needed such methods to enhance their knowledge, productivity and wages.

Summary

During the first year, the extension staff succeeded in initiating a number of educational programs, many successful and some needing restructuring. They reached thousands of Iowans with these programs and intended to expand dramatically the following year. They participated in national organizations, supporting the cause of engineering extension and winning for Iowa State recognition as the site of a new and vital extension organization, modeled on the department in Madison. The staff in Ames had every right to be proud of their accomplishments.
FOOTNOTES

1. Minutes of the Board of Trustee and Board of Education Reports, 15 July 1913, p. 345. [Microfilm, ISU Archives]

Minutes of the State Board of Education, vol. 1, 31 July 1913, p. 490. [Microfilm, ISU Archives]


4. Proceedings of the Central Association of Science and Mathematics Teachers, 8th annual meeting, 27-28 November 1908, p. 5.


7. Ibid., p. 114.


16. R. B. Dale wrote the following journal articles:


A report listing the publications of the extension staff members, dated November 24, 1915 listed six articles for R. B. Dale under the title of Editorial Contributions. The articles all appeared as listed in the Editorials in *Power*. The titles also matched exactly, but nowhere in the journal did Dale receive recognition as author. Only the archival source linked Dale to the editorials, and although it is likely correct, it is not corroborated by the journal. The editorials are:


23. Kenneth G. Smith, "Four Months of Engineering
253

Extension," Iowa Factories 3(2) (February 1914):22.


28. Ibid.


31. Ibid., p. 4.

32. Minutes of the Iowa State College Faculty Meeting, 6 May 1913. [ISU Archives]


34. Minutes of the Finance Committee, vol. 1, 8 October 1913, p. 600.

35. Smith, "Four Months of Engineering Extension," p. 22. This article also contains a photograph of the two year students working in engineering wood-shop, p. 20.


39. "Two Year Courses in Engineering to Be Revised,"

41. Minutes of the Board of Deans, 1 December 1913. [ISU Archives]

42. Ibid., 8 December 1913.

43. Ibid., 9 March 1914.


45. Minutes of the Board of Deans, 30 July 1914.

46. Ibid.


51. Ibid.


53. J. Will Parry, "Results of Automobile Institutes Held Feb. 1, to June 13, 1914," (ISC: Typewritten report of the Engineering Extension Department), p. 2. This report was unsigned, but in a letter dated May 22, 1914, J. Will Parry cited his report, called "The Results of the Automobile Institute." In addition to the title similarity, the report on institutes also contained statements that placed its writing very close to May 22, 1914.

54. Ibid., p. 3. For a listing of the locations, dates, attendance figures, see p. 2.
55. Ibid.


64. J. Will Parry, "Industrial Short Course at Ames," *Iowa Factories* 2(12) (December 1913): 11.

65. J. Will Parry, "A Report of the Winter Short


66. For a list of the participants and their addresses, see "A Report of the Winter Short Course," by Parry, p. 5-6.

67. Ibid., p. 4.

68. Ibid.


72. E. H. Cunningham in "Industrial Education for
Trades Endorsed," p. 27.


/5. "A Report on The Painters' Short Course Jan. 6-10, 1914," (ISC: Typewritten report of the Engineering Extension Department), p. 7. Author not indicated on document, but it was likely J. Will Parry, for in May, 1914, he delivered a such a report to Smith. [ISU Archives]


State Board of Education Reports, 8 December 1913, p. 460.


79. For a list of their names and home addresses, see "A Report on The Painters' Short Course," pp. 6-7.

80. Ibid., p. 3.


84. Ibid., pp. 4-5.

85. Ibid., p. 3.

86. Ibid., p. 2.

87. This law passed through the Iowa Senate as Senate File 205 and after approval on March 29th it became Chapter 248, Acts and Joint Resolutions Passed at the Regular Session of the Thirty-Fifth General Assembly of the State of Iowa (Des Moines: Robert Henderson, State Printer, 1913), p. 266.


91. Ibid.


93. Ibid.


95. Ibid.


98. "New Engineering Courses Popular; Smith Directing the New Lines of Work; Two Year Course Inaugurated - Engineering Extension Broadens Dept.," Iowa State Student 39(2) (16 September 1913):10.


100. Ibid.


105. Ibid.


110. Squyer appeared on the list of freshmen in 1908-09, as sophomore in 1909-10, as sophomore again in 1910-11, and as senior in 1911-12, Iowa State College Catalogs.


113. Ibid.

114. Ibid.

115. Ibid.

116. Ibid., p. 11.


118. Ibid., p. 12.


121. Ibid., p. 15.


127. Ibid., p. 63.

K. C. Shenehon in discussion, ibid., pp. 65-68.

129. R. L. Wales in discussion, ibid., p. 64.


Smith and other staff members had hammered out the basic direction for the department during its first year. Although it grew and entered new areas, the basic outline of work remained relatively consistent until the Spring of 1917. Two momentous events occurred then which drastically altered both the philosophy and activities of the department, the approval of the Smith-Hughes Act on February 23, and the US entry into World War I on April 6, 1917. Before those events reshaped the extension work, it enjoyed a few years expansion both in programs and in influence. This occurred not only in Iowa but throughout the nation, making the immediate pre-war period a "golden age" for university extension. On a national level, extension supporters created the National University Extension Association and guaranteed the central position of extension in the Land Grant College Engineering Association, and later in the AAACES, after the engineers
joined the agriculturalists. These organizations helped coordinate the burgeoning extension activities in many states. In Iowa, the expansiveness led to growth in the seven major lines of work: correspondence instruction; the trade school; technical lectures which came to include motion pictures; winter short courses; teacher education; local vocational courses; and the technical service bureau.

Correspondence Instruction

The enrollments in correspondence instruction proved to be highly dependent on the availability of local classes. As cities and towns began to provide vocational programs, many students preferred such courses to the instruction by mail. This shift did not occur till the 1915-1916 year, for during the 1914-15 year, the enrollments increased sizeably. In July, 1915, R. B. Dale submitted a report to Smith summarizing the developments in correspondence work for the 1914-15 school year. He felt the increase in enrollment from 230 during the previous year to 406 indicated the health of the program. In addition, during the previous year students from 21 communities participated and this figure also grew, numbering 30 cities before the end of the 1914-15 year.(1)
These students had a rather wide range of selections, for the correspondence department offered 26 courses for credit in the two year work and 4 college credit courses in mathematics. Though many of these offerings utilized materials from the University of Wisconsin, the courses prepared in Ames included one in shop mathematics, and three additional courses not yet fully completed. (2)

During the 1915-1916 school year, the enrollment dropped dramatically, for a report cited only 64 correspondence students. (3) The increasing availability of local classes provided instruction for those students previously drawn to in correspondence. While the newer students did not join the correspondence work, those already committed to it did finish their studies. Many of the serious students who began correspondence work in 1912 and 1913 stuck with the program and in the month of March, 1915, 20 students completed correspondence courses and received certificates. (4) In April, another 20 students completed correspondence work, but few replaced them. (5)

Though the correspondence work continued until World War I, its emphasis began to shift from mass instruction to the development of curricular materials for public schools and vocational schools. In 1915, several of the
correspondence courses appeared as text books, intended for use in high schools and consolidated schools.\(^{(6)}\) R. B. Dale, who excelled in the preparation of instructional materials, worked up correspondence courses and published them as books designed to serve either as textbooks or as correspondence lessons. In 1915, he published *Arithmetic for Carpenters and Builders*, which appeared in two forms, as a book and as a series of pamphlets.\(^{(7)}\) Dale designed the book so that students with an 8th grade education could manage it and hoped it might become a text book in vocational schools, trade schools, and manual training programs. He followed that book with another in 1916, *Drawing for Builders; A Problem Course in Architectural Drawing*.\(^{(8)}\) Beside its immediate use in Ames, this book received notice in Massachusetts, where it became a text book in engineering extension work.\(^{(9)}\) In addition to these publications, he also organized a course on sheetmetal drawing, which came into use in September, 1915.\(^{(10)}\)

The engineering extension department might well have established itself as a leader in the development of specialized technical curricula. Not only did the public schools utilize its materials, but industrial organizations also began to turn to Iowa State for assistance in technical education. The Permanent Building Association
sent a representative to meet with Dale in 1916 concerning his assistance in organizing instruction in building construction for that association. Such opportunities did not mark the beginnings of a role for extension in curriculum development, for Dale did not stay at Iowa State but resigned effective September 1, 1916 taking a position as chief mechanical engineer of the Eire Iron Works in Eire Pennsylvania. After he left, the curriculum writing activities languished till the War and the Smith-Hughes Act changed the extension department.

Trade School

Change and growth characterized the two year engineering work, also called the trade school, which continued along the lines established in 1913. While only 15 students attended during its first year, the enrollment for the 1914-15 school year numbered 37 students, ranging in age from the youngest at 17 to the oldest at 27 years. In June, 1915, certificates went to three young men who had then completed their work, the first group of graduates from the trade school. The following year 39 students began in the trade school. This level remained fairly stable, for in the Fall of 1916, 44
attended the two-year course. (16) Although some of the young men enrolled in the course dropped out, some also moved toward deeper involvement in academic work. Smith asserted that a "number of our two year men are going into four year work to the detriment of our two-year graduating classes." (17)

This growth in class size led to a need for increased staff, for initially R. B. Dale, with minor assistance from Smith, controlled the trade school instruction. To give Smith time to work on curriculum development and to meet the increased demand, a new man joined the department during the summer of 1915. Allen B. Campbell took a split appointment, half time as an instructor in the trade school, the other half of his time to be spent in other lines of extension work. (18) When R. B. Dale left in late summer 1916, F. J. Giehler took his place as supervisor of the vocational courses. (19) Giehler stayed less than one school year, for in March, 1917, he left to take a position with the Chicago Retort and Fire Brick Company. As of April 1, O. H. Johnson took over Giehler's classroom work. (20) At the same time as Giehler joined the department, William R. Little also took a position as instructor in the trade school, and to round out the program, both O. H. Johnson and R. H. Leavell taught in the
two-year course.(21)

The course content changed little from the first year, but the department did develop ways to make the teaching more practical. Early in 1915, those enrolled in the course for electricians and stationary engineers planned to spend a least one week in the central station of the Fort Dodge, Des Moines and Southern Railroad, under the supervision of the chief electrical engineer, L. M. Mottinger.(22) Those in surveying and road making were to work a week with the city engineer in Des Moines.(23) Two students also traveled to Marshalltown, where they spent one week in the C. A. Dunham plant.

Besides this type of short term cooperative education, Smith also helped begin informal placement activities, working to find employment, both permanent and summer jobs, for the two-year engineers. In February, a letter from Smith to the manufacturers of Iowa appeared as a full page spread in Iowa Factories. In it he reviewed the two-year courses and requested manufacturers to hire some of the students for the summer months.(24) In May, he repeated his request to employ the students, and even included part of a report written by one of the students visiting the Dunham works.(25)
The courses offerings remained rather stable, although several possible expansions drew attention. In the Fall of 1914, J. Will Parry attended the Fourth Annual Convention of Master House Painters and Decorators, which began August 27 in Davenport. He spoke about the dearth of educational opportunities for painters, citing the systems of continuation schools developed in Wisconsin, Massachusetts and Indiana as a satisfactory solution in the long run, but of little value in providing some immediate relief. In his view, the situation demanded a different type of response than that typical of educational institutions. "We, as a state college, must make a radical departure from the traditions and customs of all colleges and embark on a field which is as yet untried."(26) Parry's proposal supported the establishment at Ames of a 12 or 18 month course, which consisted of short units, each approximately 6 weeks in length. Students could complete the short units as they could find time and on completion of the full course receive recognition as a "finished mechanic" by the Painters Association.(27)

The extension department also tried to build a working relationship with the Iowa Clay Products Manufacturers Association, hereafter the ICPM, for in December, 1913, J.
W. Parry addressed their convention on the topic, "The New Short Course for Clay Products Manufacturers at Iowa State College."(28) This contact did not immediately result in any extensive training for clay workers, but in February, 1916, the IPCA held its annual meeting at Iowa State College. Following upon an address about a dearth of contractors competent to use clay products, the association passed a resolution which requested the college to establish courses for the training of mason contractors. As a result of this resolution, members of the ICPMA met with the extension staff, hoping to persuade the staff to place masonry work on equal footing with carpentry in the two-year course on building construction. They felt successful in that mission, for an article, "Iowa Fills a Need," claimed that the college offered courses that would make contractors out of ambitious young masons.(29)

The notion of tailor-making a program to suit the needs of another group of industrial employees arose in October, 1914. Ten leaders of the Iowa Independent Telephone Association, hereafter IITA, came to Iowa State to discuss with the electrical engineers and the extension staff the potential of courses for telephone operators and telephone plant men.(30) The IITA, which consisted of owners and managers of several small Iowa telephone
companies, found the extension staff eager to serve that educational need. The work for telephone operators remained in the short course format and did not develop into a course in the two-year trade school.

Initially, J. W. Parry planned to hold operators' schools in four of five cities during the Winter of 1914-15 and to issue technical bulletins on methods of telephone operation. This work began early in 1915, prior to the IITA annual convention. Miss K. M. Gang conducted a school for telephone operators, a four day course on voice control, cord and key handling, and operating methods. These sessions occurred in Creston, Sac City, and Washington, drawing a total of 67 participants. Miss Gang also conducted the same classes in conjunction with the annual convention of the IITA, teaching 41 women in Des Moines. These training sessions won not only the support of the IITA, but the Bell Telephone Company, which had its own training schools, wanted to cooperate with the program the following year. Consequently, the extension staff planned to supply 16 sessions, each lasting two days, to train operators.

Although having a similar beginning, the training for telephone plant men developed into an offering in the two-
year trade school and also into the introduction of telephone work into the four year course for electrical engineers, which began in 1916. J. W. Parry organized a series of training sessions for telephone plant men to occur during the annual convention of the IITA, held in Des Moines, March 9-11, 1915. The training for plant men involved six sessions which provided demonstrations and technical information on line construction, circuits, and the use of instruments to locate troubles. These meetings were so popular that some of the convention sessions adjourned "for lack of attendance." The convention further showed its approval by adopting a resolution commending the extension department on its work on training for operators and for plantmen.

In preparation for the activities in the spring of 1916, the extension department published two announcements, one for the sessions for plant men, and one for operators. All 16 communities did receive the operators schools, which occurred in March, April, and May of 1916. Miss Gang's replacement, T. Anne Barnes conducted the sessions, reaching a total of 511 participants. This work for telephone operators continued, and in the Spring of 1917, such schools occurred in 14 cities.
When A. B. Campbell joined the extension staff, he took over the telephone work, and in October and November, 1915, he presented a paper at several meetings of the IITA. Under Campbell's guidance, the extension department also conducted two-day training sessions for a total of 52 plant men in Ottumwa, Creston, and Fort Dodge in January, 1916. The instructors at these sessions were Campbell, who had worked with the Western Electric Company and several independent phone companies, C. A. Wright, Associate Professor of Telephone Engineering and past circuit and equipment designer for the American Telephone and Telegraph Company, and G. L. Sanders, manager of the Interior Telephone Company of Grinnell and expert on telephone cables. At the 1916 convention of the IITA, Campbell and Wright worked with two men from Grinnell in presenting a school for plant men, similar to the sessions given at the previous convention.

Although these short courses for plant men received support and acclaim from the IITA, that association desired a more thorough training program. Smith had maintained contact with leaders of the IITA and conveyed to the Board of Deans their wish that Iowa State might create a three to four month course for telephone company employees. This proposal received consideration by the Course of Study
Committee, and rapidly developed into a plan for a new course in telephony in the two year engineering work. In March, 1917, J. Will Parry addressed the annual convention of the IITA, reporting on the programs in telephony. Beside the continuing short courses for telephone operators, he announced that a new two-year course in telephony would begin in the Fall of 1917. This program was to replace the sessions for plant men, which had been discontinued due to inefficiency and a lack of uniformity in instruction. According to Parry, the students of telephony, already employees of a phone company, would attend in Ames from October to May, leaving them free to work for the company during the spring and summer months. In contrast to the proposals about special training for painters, which did not materialize into courses in the trade school, the telephone industry, through the IITA, did gain a new opportunity for training employees.

Technical Lectures

The technical lectures joined in the expansive character of extension before the war. The type of work established in 1913, namely direct lectures on various
topics continued, with automobile institutes as predominant. In December, 1914, Richard A. Leavell took over that work at a salary of $150 per month, $25 a month less than the compensation for R. E. Davis. One report identified Leavell as a "garage man" from Chicago who had made a success of the "rebuilt car business." He had also worked in the engineering department of the Warner Gear Company, and in inspection and testing with the Interstate Automobile Company and the Stromberg Motor Devices Company. He led the automobile work in the engineering portion of the winter short course, December 28 - January 2, 1915, which drew 25 participants, mostly farmers. After the winter short course, Leavell also conducted automobile institutes in 17 cities with an estimated total audience of over 11,000 people. Beside presenting the lectures in person, he also brought several in printed form, as bulletins of the extension department. During the Summer of 1915, Leavell worked with the American Automobile Association at car races. He operated official timing equipment at the Chicago Speedway, the Des Moines Speedway, Twin-City Speedway, Sheepshead Bay Speedway in New York, and at dirt tracks in Sioux City, Omaha, and Burlington. He also gave lectures and demonstrations in early autumn at the State Fair.
While Leavell's lectures constituted the majority of all technical lectures, he was not the only lecturer. As in 1913, Smith also delivered a number of lectures. On one occasion he arranged to lecture about 50 employees of the Rock Island Railroad in Cedar Rapids, meeting with them during their noon hour every day for one week. (57) Such lectures remained popular, but the utilization of films in conjunction with lectures, as begun by Smith in 1913, led to a new area of development.

Motion Pictures

In January, 1915, the extension department began a moving picture exchange, offering to loan the films on fire prevention, industrial education and safety it acquired through the NAM. (58) J. Will Parry, who took up much of the responsibility for the film work, conducted a survey of all the high schools in Iowa to ascertain their involvement with motion picture equipment. He found only three schools with movie projectors, but many interested in the use of films. Consequently, he traveled to many public schools, demonstrating the use and care of motion picture equipment and giving recommendations to schools concerning possible purchases of such equipment. His work as "consulting
engineer" on motion picture equipment led him to demonstrate educational films in Webster City, Fort Dodge, Creston, Chariton, Ottumwa, Oskaloosa, Fort Madison, Burlington, Cedar Rapids, and Keokuk.(59)

In April, 1915, the extension department published a bulletin entitled "Motion Pictures in the Schools; A Plan Proposed by the Engineering Extension Department Iowa State College."(60) It provided data on films and equipment, and offered the services of the department to schools planning to begin film use. As this work developed, the extension department began to operate a circuit, which served high schools in 15 communities during the 1914-15 year and by January, 1916, included 24 public schools. The department had twelve films related to industry and safety, which it scheduled so that the schools regularly received a film.(61) During the 1915-16 school year, the extension department supplied the films that appeared in over 500 exhibitions.(62) By the Fall of 1916, the department had more than 100 film programs available for loan, and an increasing number of borrowers.(63) Parry's leadership in developing the film service did not go unnoticed, for in March, 1917, he received appointment to the national committee on visual instruction in the National University Extension Conference.
Short Courses

The extension staff planned to turn the winter short course into a major gathering of industrial leaders and workers. In keeping with this plan, they renamed the course the Industrial Congress. An announcement in November declared the old style course had been abandoned and the new meetings will "take on the air of conventions or congresses where the men of every important industry from all over the state will meet to discuss and work out their perplexities with the aid of the best engineering facilities in the west." (64) This meeting occurred December 28 to January 2 and included the Second Annual Convention of the Road School and County Engineers. Two engineering professors, Meeker and Porter, lectured on steam engines, and R. A. Leavell presented a course on the automobile. (65)

Judging by the lack of reports in Better Iowa, a biweekly publication of Iowa State College, which carried the subtitle, "A Clipping Sheet of Industrial News for Iowa Newspapers," the industrial congress flopped. Although it did attract speciality groups, apparently the general
engineering lectures did not draw crowds. Leavell's auto
institute drew only 25, a fraction of the number he drew at
other presentations of his institute.(66)

In contrast to that rather poor showing, the second
annual short course for painters and decorators fulfilled
expectations. About sixty painters attended the course,
which ran from December 28, 1914, to January 2, 1915, and
consisted of two hours of lecture and six hours work each
day.(67) Though most participants came from Iowa, the
course also drew men from Nebraska, South Dakota, Indiana,
and Illinois.(68) The previous instructors returned, John
W. Luthe of Cleveland instructing in woodfinishing and A.
Abel of Sioux City in wall work. One of the lectures given
by Luthe on problems associated with various paints
warranted publication.(69) In addition to those
instructors, the one other man most responsible for the
success of the course was F. M. Michael. He donated his
time and paid his own expenses in the organizing work he
carried out prior to the course and also in his efforts as
an instructor.(70) During the practical work, they
decorated the Delta Tau house and another large club house
on Lincoln Way.(71) Another aspect of the practical work
involved the preparation of an exhibit of grained, mottled
and stenciled panels. This exhibit later appeared at a
convention of Master House Painters and Decorators of the United States and Canada in Washington. (72) This did not represent the first contact between the course in Ames and the international painters' association. Following the first course, 1913-1914, the International Association of Master House Painters and Decorators passed as a resolution commending the course and citing it as an example other states should follow. (73) This contact with the International Association continued, for an announcement for painters' short courses in early 1916 included a letter from the past president of the International congratulating Iowa State College on its leadership in trade education. (74)

Following the winter short course season, Smith and the other extension workers began plans to provide short courses for plumbers and steam fitters, firemen, and janitors. In comparison to the other short courses, these classes, which lasted one week, would be delivered wherever a minimum of 12 people enrolled. That amounted to a short term local course or a portable short course. (75) This style of local short course proved so popular that in November, 1915, a course for janitors and firemen in Sioux City drew such an enrollment that it ran twice. The incentive came from the local school board which required
all its janitors and firemen to attend the course and also paid them for complying.(76)

The winter short courses taught on the campus near Christmas, 1915, did not claim recognition as an industrial congress. The engineering work remained tiny in comparison to the agricultural courses, for only about one person in eight attended the engineering courses, the most popular of which were automobile work, electricity for farm lighting, and house wiring for farm lighting.(77) The courses, called work in general engineering, also included practical concrete work, road building, and electricity for farmers. These general engineering courses drew nearly 100 people, with about 70 at a convention of clay workers, and 100 at a meeting of county engineers about good roads.(78) The most successful short courses exhibited direct ties with existing organizations of employers or craftsmen. In particular, the painters continued to utilize the courses to great advantage.

The painters' courses for the 1915-16 season did not occur in Ames, for the painters' association organized similar trade courses to occur in other cities. Under the supervision of Luthe and Abel, courses occurred in Waterloo and Council Bluffs. In Waterloo, one course began January
10, lasting 4 weeks, and another began February 7, for a one week duration. In Council Bluffs, a one week class began February 14. (79) The four week course represented a trial effort and met with many difficulties. The biggest problem lay in wide differences in the experience of the participants, ranging from one week to 28 years. A group so diverse proved almost unmanageable and as a result, J. W. Parry concluded that the four week course was "not adapted to this work." (80) These one week courses proved so popular that the extension department planned to conduct six courses in 1917, to run in Dubuque, Davenport, Des Moines, Fort Dodge, Council Bluffs and Ames. (81) The fruit from these plans equalled the expectations, for each of the six cities guaranteed minimum enrollments of 24. (82)

Although starting three years after the painters, the Iowa Master Bakers' Association instigated a short course in Ames, which also coincided with their annual convention. This format, which proved so successful for the painters, also characterized a number of courses in baking, the first of which occurred in February, 1917. At that time, the Iowa Master Bakers' Association and the extension department offered a three day short course for bakers. (83)

The range of activities associated with the winter
short courses reflected the efforts of the extension staff to seek out many opportunities for educational service. While not all their attempts met with success, they continued to try new areas and to expand those efforts which gained approval. The winter courses occurring at the close of 1916 included traditional classes in electricity, automobiles, gas engines, and concrete use. It also involved members of the Iowa Clay Products Manufacturers Association, the Permanent Buildings Society, and a convention of County Engineers. (84)

Teacher Education

Efforts to provide instruction for teachers had begun with the short courses in manual training for rural teachers, designed to fulfill the state certification requirements. By December, 1914, the extension staff had prepared a series of bulletins to assist rural teachers in the introduction of manual training. Included in the bulletins were directions and plans for 14 useful items which could be made with inexpensive materials and common tools. (85) These materials also appeared useful to the
Iowa State Department of Public Instruction, for in January, 1915, it began work on an outline for the teaching of manual training. This outline included the bulletins from the engineering extension department, and expanded on them with the hope of beginning to unify and standardize such instruction. (86)

The instruction for rural teachers grew in two directions, that of including manual training work in summer sessions, and that of expanding the in-service type sessions. During the summer session of 1915, manual training courses were available with no tuition fees, with F. P. Reed hired to teach that summer and John Hug appointed Associate Professor of Manual Training, teaching half time during the summer session. (87) At the start of the 1915-16 school year, F. B. Reed and W. T. Giese assisted in the manual training work. Both men held positions as teachers of manual training in the public schools, and did work for the extension department on "follow-up manual training." (88) A student, M. C. Pervier, a senior in the industrial science division, joined them as a special instructor in manual training follow-up work. (89)

The procedure used to reach the rural teachers involved Saturday classes. These classes, which met every
Saturday, attracted enrollments from 17 to 25 teachers, depending on the location.\(^{(90)}\) The instruction generally focused on woodworking and drawing, and as the popularity of the program grew, the extension department began to hire local instructors for some of the Saturday classes. During the fall of 1916, three such instructors assisted the extension department, C. B. Woodstock of Lamoni, F. P. Reed of Osceola, and E. S. Baird of Newton.\(^{(91)}\) They also focused on woodworking and drawing, but in early 1917, the extension department added a new offering. "To make manual training work in rural consolidated schools still more practical to farm boys, instruction in concrete work will be added to the list of subjects in which the Engineering Extension Department will instruct teachers of these schools."\(^{(92)}\)

While the off-campus program for working teachers bloomed, manual training also entered the four year curriculum on campus. In late 1915, a course in manual training and woodworking, identified as Mechanical Engineering 140, began and drew a number of students, including 35 young women.\(^{(93)}\) The *Iowa Engineer* reported, "A constantly increasing number of girls and Ag. Education students are taking this work (manual training) and the wood shop is too crowded for greatest efficiency."\(^{(94)}\)
This crowding remained a problem till the completion of a new foundry for the mechanical engineering department and the remodeling of the old foundry for manual training instruction. (95)

To help oversee the manual training work, in August, 1916, the department hired Henry T. Giese as a part time employee of the engineering extension department to work on manual training extension and correspondence work. (96) The manual training summer courses, which began as retraining for teachers, grew to serve both existing teachers and students intending to teach. The summer session of 1917 brought increased emphasis on vocational education by importing nationally known leaders of vocational education. Among them was Dr. C. A. Prosser, Mr. Gunsalus of the Armour Institute, and W. A. Foster of Pennsylvania State Normal. (97)

Local Classes

The local classes, the largest of the seven major lines, provided the most direct educational service of the department to industrial employees. The courses grew in number and size, so that by the end of December, 1916,
local courses ran in 14 cities with a total registration exceeding 400. An important factor in the success of these local classes came from the support of industries and the public schools. The programs in Waterloo reflected close ties with manufacturing concerns.

In the fall of 1914, O. H. Johnson worked with the Litchfield Manufacturing Company of Waterloo to set up a trade school operated by that company in its factory. That school started with 43 students and two instructors, O. H. Johnson and Clarence E. Shiplet, the plant engineer for the Litchfield Company. Johnson personally directed the first few classes, then turning over the daily activities to Shiplet, although Johnson remained in close contact with the instruction. Such factory schools also sprang up at the Galloway Company and the Iowa Dairy Company of Waterloo, all under the direction of the extension department.

One reason for the amount of activity in Waterloo was the full-time presence of Johnson, who organized many activities. Also, Johnson had established himself with various organizations in Waterloo. He served as chairman of the Black Hawk Gas Engine Association, a Waterloo branch of the National Gas Engine Association, which had among its
more than 100 members the leading manufacturers of Waterloo. (101) Due to Johnson's efforts, the extension work in Waterloo expanded and by January, 1916, it involved 9 instructors and 200 students. (102)

Some of the extension classes began independently and once established became attached to the local public schools. In Clinton, the extension department had directed a mechanical drawing course, held in the YMCA. The local instructor felt the course was so good that he planned to personally recruit students so the next class could include 50 students. He hoped to move the course into the high school, for he wished to utilize its drawing room equipment. (103)

Other extension programs began in cooperation with the public schools and won high praise from the educators involved. The principal of the Fort Dodge High School wrote to Smith, expressing his support of the extension work, which had enrolled more that 150 people in six different courses. (104) In Burlington, the local school authorities helped pay for the extension classes. (105) In Cedar Rapids, the school officials not only footed the bill for extension classes, they arranged to offer an extension class in the vocational high school as one of the regular
vocational courses, although the organization came from Ames. (106)

Technical Services

The last major line of work also displayed expansive characteristics before World War I. The Technical Service Bureau, started by J. Will Parry, received a new leader in August, 1914, when D. C. Faber joined the staff as "Industrial Visitor." (107) He held a degree from the University of Illinois and took an appointment half time in extension and half time in the engineering experiment station. A large portion of his efforts went into the location of industrial problems that the bureau might solve. To do that he visited manufacturing plants, and city government officials, and attended many conventions and association meetings. (108)

Faber began his activities with the hope that the bureau might directly help industries through assistance with technical problems. This notion, which appeared in an article published in October, 1914, did not become a reality. (109) The hopes that the bureau might directly assist industry ran into the disapproval of many practicing
engineers. To guarantee that the college would not seriously infringe on the employment possibilities of such engineers, the service bureau organized an advisory committee. It consisted of 16 municipal and industrial engineers, who sought to restrict the bureau to educational work, so that "direct engineering service will not be rendered." (110)

With direct assistance to industry virtually forbidden, the service bureau concentrated on problems facing cities and towns. The city of Muscatine wanted assistance in developing a method of garbage disposal, and the extension staff consequently conducted an investigation and published a bulletin, "Collection and Disposal of City Refuse." (111) Many towns requested assistance, and by July, 1915, 71 cities and towns used the Technical Service Bureau to help solve a wide range of problems. (112) Some of the most common requests concerned water supply, street lighting, sewage and garbage disposal and street construction. (113) These concerns became the topics of several extension publications. (114) Before World War I, the service bureau continued to work with many cities and towns. Between September, 1915, and June, 1916, 62 municipalities utilized the services of the bureau. (115) These efforts also led to more publications along the lines
begun in 1914-15. (116)

While the majority of its efforts involved municipal agencies, the bureau also conducted a few activities of value to individuals. One such service involved testing oil, and notices enjoined farmers to send a bottle of their oil to the extension department for testing. (117) In this manner, the engineering extension department sought to emulate the services provided farmers through the soil testing work of the agricultural extension workers.

Professional Organizations

The professional responsibilities of the extension staff increased dramatically in the years prior to 1917. Extension workers actively participated in the LGCEA, the National University Extension, and various teachers' organizations. These activities kept developments in Iowa in the forefront of organizations which supported extension. Particularly in the LGCEA, conflicting notions of professionalism became crucial as the organization tried to shape its future.

At the third meeting of the Land Grant College
Engineering Association, Washington D.C., November 10-13, 1914, the issue of the status of engineering extension took center stage. Two papers were presented on the functions of a university, one by C. H. Benjamin, Dean of Engineering at Purdue, and one by F. E. Turneaure, Dean of Engineering at the University of Wisconsin. They represented the sharply pro and con positions on engineering extension.

Benjamin voiced the critical position saying,
"In other words the university at home or abroad should do no teaching which is not of university caliber and should teach no subjects for which credit cannot be given on the university books. We have gradually been getting rid of those most undesirable nuisances, the irregular and special student and the short course man, so that no one can claim to be a student of the university unless he is matriculate in the regular four-year course. Let us not again allow any lowering of the standard."

Dean F. E. Turneaure of Madison presented a response to Benjamin's paper. He supported the vocational educational efforts of colleges in supplying courses to fit between the instruction available in public schools and the four-year engineering courses. He pointed out that a
difficulty in extension work arose from "the desire on the part of school men to ride two horses and to give such semi-vocational work as may be of some value and at the same time be accepted for entrance to college." He went on to draw a conclusion from this tendency.

"The result is that the instruction is likely to be satisfactory neither as vocational nor as college preparatory work. Why not frankly provide such vocational instruction as experience has shown elsewhere to be most helpful in a vocational way and drop the college question until that is done?"(119)

In the discussion following the presentation of these two papers, support for Turneaure came from E. B. Norris of Madison, Dean D. W. Spense of Texas, Dean E. S. Keene of South Dakota and President C. A. Lory of Colorado.(120) Turneaure also restated his position, saying, "It is a question which has occurred to me many times as to whether it has been the wise thing, on the whole, for all of the land grant colleges to separate themselves so far from the industrial population, who need secondary education, as well as engineering education - whether short courses such as we have been considering should not have been established and retained."(121)
Support for Turneaure also came from P. P. Claxton, of the U.S. Bureau of Education, who brought a new direction to the discussion. Instead of arguing about the ideals of land-grant institutions, he indicated that many colleges did not "confine themselves to what should be regarded strictly as college work." (122) Since, according to Claxton, about forty percent of college freshmen quit within one year, "most of the work done in American colleges in short-course work in fact whatever it may be in theory." (123)

The extension program in Iowa embodied most of Turneaure's views. Although the representatives from Iowa, Dean Marston and C. S. Nichols, did not stand out in the discussion on the two papers, the program in Iowa did receive considerable attention. Marston served as President of the Association for the 1913-14 school year, and K. G. Smith, although not in attendance, did promote the program in Iowa. Beside sending a paper, "Methods of Instruction in Engineering Extension," he also served as a member of a committee on engineering extension textbooks. (124) That committee did considerable work prior to the convention in 1915, when it presented a report on the type of books needed. (125)
Although the promoters of extension did not enjoy the unanimous support of the LGCEA, they did maintain extension as a central element of the organization. That role did not change as the LGCEA moved toward merger with the AAACES. The fourth meeting of the LGCEA was held together with the 29th convention of the AAACES, August 11-13, 1915, in Berkeley. At that time the engineers joined the Association on equal footing with the agriculturalists. H. W. Tyler, President of the LGCEA, cited two activities of the engineering association as preeminent, first, engineering extension, and second, the engineering experiment stations. By the 30th convention, the new Engineering Division of the Section on College Work and Administration was on full force. Although Dean Benjamin continued to voice his objections to extension work, the division heard two papers on mechanic arts work of sub-collegiate grade, both of which supported extension. The discussions generally favored the work, and included a few strong words, such as those supplied by R. L. Wales from Rhode Island. He disagreed with Benjamin's view, stating, "We would not be fulfilling our full functions under the law if we dealt only with the higher technical courses and if we absolutely neglected that other and possibly more important field which is the subject of our discussion."
Although the merger of the LGCEA and the AAACES brought engineering extension into a powerful national organization, that organization did not monopolize its promotion. In March, 1915, a new national organization arose to help coordinate all the types of extension activities which were expanding in many state colleges and universities. Representatives from 22 universities and colleges met in Madison, March 10-12, and established the National University Extension Association, hereafter NUEA. To a large extent, the organization grew out of the efforts in extension at the University of Wisconsin.

An indication of Wisconsin's leadership appeared in the number of its faculty attending as well as their leadership positions in the conference. Seven professors and seven other Wisconsin residents attended. In addition to them, President Van Hise delivered the opening address, "The University Extension Function in the Modern University," at the evening session. Van Hise's message had at its center the assertion that service to the public should be essential for any university. "If a university is to have as its ideal, service on the broadest basis, it cannot escape taking on the function of carrying knowledge to the people. This is but another phraseology for
The NUEA promoted all types of university extension, but because the bulk of extension work involved agriculture, home economics and engineering, other extension activities, such as extension landscape architecture, remained minor aspects. The relative importance of engineering extension in the NUEA reflected its strength as a national force, and prior to World War I, engineering extension held a major position in that organization.

At the first meeting of the NUEA, both J. Will Parry and K. G. Smith represented Iowa's engineering work. Smith presented a paper, "Engineering Education in Extension," which began by distinguishing three categories which comprised the content in engineering extension, namely vocational, technical, and "engineering proper." He conceded that "the line of demarcation" between these categories was not "always clearly defined," but chose to focus on technical engineering work, which meant "the dissemination of information of a technical character in such form as to be used at once by the average man...." As elements of such technical work he included technical lectures, institutes, short courses,
publications, and efforts of the technical service bureau. In other words, he identified as technical work all the extension programs except those directly vocational in content. By identifying the scope of extension as including vocational, technical, and engineering instruction, he laid claim to a very broad area.

Smith's hopes for highly diverse engineering extension did correspond to its national development prior to World War I. Though the NUEA did not clearly document to extent of engineering extension on a national level, the reports about state programs all showed growth. During this period, Smith maintained an active role, and for the second meeting of the NUEA, April 12-14, 1916, he prepared a paper, "Cooperation with Private Associations and Organization - National, State, and Local." Although Smith did not read his paper, for he was unable to attend, J. Will Parry presented it for him. In it, Smith discussed national organizations, local organization, and manufacturing firms. The report also served as an occasion to advertise the work in Ames, summarized the extension activities in Ames, for he used his own work as an example of the wide range of organizations participating in the efforts. The following year, Smith had no paper to present, but Parry kept up a presence for Iowa State. He
received an appointment to the national committee on visual instruction, and also presented a short report, "Carrying Charges for Visual Instruction Materials."(134)

In addition to work with these two national organizations, Smith also carried his message to one other major engineering society. On February 1, 1915, he presented a paper, "Methods of Instruction in Engineering Extension," at a meeting of the Western Society of Engineers in Chicago.(135) The paper amounted to a general review of the extension department in Ames. Several engineers in the audience expressed support for the technical service bureau, and others felt extension might offer a solution to an oversupply of engineers. Smith agreed with that view, asserting, "we advise too many young men to become engineers."(136)

Smith also played a prominent role in several teachers' organizations. He traveled to Chicago for a meeting of the Central Association of Science and Mathematics Teachers on November 27-28, 1914. At the meeting in 1912, the mathematics section created a committee to investigate vocational mathematics.(137) The chairman of that committee, R. L. Short, a teacher from West Technical High School in Cleveland, delivered the
first report of the committee at the meeting in 1913. Smith's reputation in vocational mathematics was rather high, for Short quoted him in his report on vocational mathematics.(138) In addition, the mathematics section elected Smith chairman of the Committee on Vocational Mathematics, a position he held for three years.(139) In 1914, Smith, in his capacity as chairman of the Committee on Vocational Mathematics, delivered the report for that group. Although vocational mathematics encompassed industrial, commercial, agricultural, professional and domestic science divisions, industrial mathematics dominated its activities. In part, this stemmed from a feeling among the committee members that industrial mathematics was "most complicated and least understood."(140) Before America's entrance into World War I, Smith continued to emphasize vocational mathematics in the CASMT.

Smith developed few other contacts with large teachers' organizations. Although he traveled to Richmond, Virginia for the annual meeting of the NSPIE in December, 1914, he played no prominent role in that organization.(141) However, due to the growth in the teacher training programs conducted by the extension department, Smith kept close contact both with public
school officials and other college teacher-training courses. This led to his work with several state organizations, and in April, 1915, the Northwestern Iowa Teachers' Association elected him chairman of the college and normal section.(142) The State Teachers Association also placed Smith and a representative from the Teachers College on a committee to work on a course of general science for the public schools. They were to deliver a report on the course in the fall of 1916.(143)

Summary

During the years just prior to World War I, engineering extension programs flourished in many states. The efforts in Iowa expanded in most lines and tried out new areas of service. The cooperation between various organizations of manufacturers and industrial workers grew dramatically, leading to dynamic short courses and conferences in several cities. Accompanying this expansion, the extension staff, particularly Smith, provided leadership in several professional groups, those of both engineers and teachers. In so doing, they brought deserved recognition to Iowa State and its extension department.
FOOTNOTES


5. "Correspondence Students Complete," The Alumnus


12. Board of Education Reports, 6 July 1916, p. 281. [Microfilm, ISU Archives]

A. B. Campbell, "Report of the Vocational Courses in
Engineering for the Year 1916-1917," (ISC: Typewritten report of the Engineering Extension Department, 1 July 1917). [ISU Archives]


For a list of their names, ages, and previous occupations, see "Report of Vocational Courses and Correspondence Courses 1914-1915."


Extension Department, 31 December 1915).


20. Ibid.


27. Ibid.


31. Ibid.


"Plan School For Phone Girls," *Better Iowa* 1(5) (25
January 1915).


"Report on Telephone Operators' Schools 1914-15."

35. For a listing of the 16 towns, see "Report on Telephone Operators' Schools 1914-15."


38. "Report on Telephone Plant Men's School 1914-1915."


"Improve Telephone Service," *Better Iowa* 1(27) (18 October 1915).


44. "Telephone Men Go To School," *Better Iowa* 2(7)
(17 January 1916).

45. "Announcement of Schools For Telephone Plant Men."


47. Minutes of the Board of Deans, 27 Feb 1917.


"Telephone Course To Be Installed," Iowa State Student 42(77) (14 April 1917):1.


52. "The Automobile Institute, Second Annual Season," (ISC: Engineering Extension Department, 1914).


55. Leavell wrote the following Automobile Institute Bulletins for the Engineering Extension Department:

"Some Points on Carburetion," no. 8, vol. 14, no. 6, 10 July 1915.


"Care of the Water Cooling System," no. 27, 20 January 1917.


60. "Motion Pictures in the Schools; A Plan Proposed by the Engineering Extension Department Ames Iowa," (ISC: Engineering Extension Bulletin 11, 30 April 1915.)


63. "'Movie' Film Programs Ready," *Better Iowa* 2(43) (25 September 1916).


70. "Report on Painters' Short Course 1914-1915."


73. "Second Annual Short Course for Painters and Decorators," (ISC: Announcement of the Department of
Engineering Extension, vol. 13, no. 17, 1 November 1914).


75. "Short Courses For Workers," Better Iowa 1(21) (23 August 1915).


"Announcement of Courses for Painters and Decorators,"


82. For the dates at the various cities, see "Double Painters' Courses," Better Iowa 3(3) (18 December 1916).


"Now Bakers Come to School," Better Iowa 3(5) (1 January 1917).


"Free Courses For Teachers," Better Iowa 1(13) (3 May 1915).


89. Ibid., 27 October 1915, p. 503.


93. "College Notes," Iowa Engineer 16(5) (February

95. Ibid.


102. Ibid.

103. Letter from F. N. Peterson, YMCA Clinton, Iowa to K. G. Smith, 29 May 1915. [ISU Archives]

104. Letter from W. H. Blakely to K. G. Smith, 13 June 1916. [ISU Archives]


108. For a list of conventions attended by Faber see D. C. Faber, "Report of Technical Service Bureau, Sept. 1, 1915-July 1, 1915," (ISC: Typewritten report of the Engineering Extension Department, 1915), p. 15. [ISU Archives]


112. For a list of these communities and the specific problems addressed, see D. C. Faber, "Report of Technical Service Bureau, Sept 1, 1914-July 1, 1915," pp. 3-11.


D. C. Faber, "Concrete Sidewalk Construction," (ISC:
During this same period, D. C. Faber also collaborated with C. M. Jansky, a member of the extension staff in Madison, in writing *Principles of the Telephone* (New York: McGraw-Hill Company, 1916).


123. Ibid., p. 30.


C. E. Hewitt and W. N. Gladson both delivered papers with the same title, "Mechanic Arts of Sub-Collegiate Grade in Land-Grant Colleges," Proceedings AAACES, 1916, pp. 212-215 and 215-218 respectively.


131. Ibid.


CHAPTER 7:
EXTENSION DECLINES - INDUSTRIAL ARTS RISES

The Smith-Hughes Act, approved February 23, 1917, and the Great War caused a massive transformation in the highly diverse engineering extension department. Its central idea had come from the broader university extension movement, namely the desire to carry the knowledge and skills of the university to large numbers of citizens. Consequently, the extension engineers in Ames sought to bring technical education to thousands. However, the war effort halted the expansive growth of extension, spurred temporary training programs designed for military needs, and removed several staff members from Ames. After the enactment of Smith-Hughes, engineering extension in Iowa lost its largest area of service, which also most clearly expressed a concern for mass technical education, namely its vocational courses in various industrial cities and towns. Not only did that key element disappear from the extension department, falling under the control of the State Board for Vocational
Education, but the related area of training for industrial teachers also moved away from extension. While the bulk of vocational work departed completely from Ames, the preparation of teachers occurred in a new department, the department of Trades and Industries, the forerunner of the Industrial Arts department.

Effects of World War I

World War I produced three major impacts on the extension department. It caused involvement with temporary programs serving women, drivers, bakers, artillery officers, and intelligence personnel. It drew students and staff members into military service, thereby further disrupting the department. It also occasioned an additional temporary effort after the armistice, one aimed at vocational rehabilitation for wounded veterans.

Because of the war, a number of women began to attend courses offered by the extension department. In May, 1917, one month after the declaration of war, the extension department began a class in automobile instruction. This course drew 33 women students and faculty members. This influx, a transient development, appeared to one observer as a direct result of the war.(1)
Another temporary effort involved the training of chauffeurs and truck drivers. Starting in May, 1917, the extension department began its first two month course in driving at the Grant vocational school in Cedar Rapids. R. L. McFarland served as instructor in the course. (2) While the training of drivers occurred beyond the perimeter of military camps, the department also went into one such camp to train bakers and artillery officers.

Direct training of enlisted men first received consideration at a meeting of the Board of Deans in July, 1917. It had been suggested that the college help prepare men as bakers for the army. Since such training did not fit conveniently into any existing programs, someone "suggested that work along this line could be given in connection with our non-collegiate work if necessary." (3) As a result, another temporary war related training task fell to the extension department, and in November, 1917, the extension staff helped organize a short course for bakers, which occurred at Camp Dodge. (4)

The work at Camp Dodge grew during November and December. Under the guidance of J. Will Parry, with some assistance from the State Board of Education, the extension
department showed several motion pictures, maintained a rack containing the more popular extension bulletins in the YMCA at the camp, and delivered various lectures. (5) These lectures included specialized presentations on structural iron and concrete for a company of engineers. In addition, Leavell spent three nights per week training officers of the 337th and 339th Field Artillery on care and operation of motor vehicles. (6)

The extension staff also cooperated with the State Council for Defense in preparing draftees in intelligence techniques. (7) The first course began in Cedar Rapids in late November. (8) It comprised instruction on military organization, military hygiene, French, arithmetic, automobile care and mapping and sketching. By the middle of January, 1918, such courses were available in six Iowa cities. Enrollments ran rather high; Sioux City and Council Bluffs reporting 132 and 125, respectively. (9)

These war related programs took the extension staff away from established lines of work, and entangled them in some totally new fields of instruction. With the armistice, such work disappeared. Those disruptions, however, remained small in comparison to the second great impact, the drain of staff and students.
The population of students dropped rapidly after the declaration of war in April, 1917. Though enrollments dropped throughout the college, the technical areas experienced the greatest loss. During May, the entire junior class of mechanical engineers completely vanished.(10)

Several extension men also left for military service. In late October, Smith left to go to Washington D.C. for work with the Federal Board of Vocational Education.(11) He did not return to Ames till September 1919, 10 months after the armistice.(12) R. A. Leavell also left to join government service, departing in late January or early February, 1918. When Smith left, J. W. Parry took charge of the extension department, but he also departed, taking a position with the Emergency Fleet Corporation in May, 1918.(13)

These departures caused both temporary and permanent changes. R. L. McFarland came to Ames from Grant vocational school in Cedar Rapids to take over Leavell's work.(14) To fill the gap in the extension staff, H. W. Meeker from mechanical engineering temporarily assisted in automobile instruction, and O. H. Johnson abandoned much of
his work in Waterloo to be available full time in Ames. (15) Charles Roach took over J. Will Parry's work with motion picture instruction, arriving during the fall of 1917. (16) Since both Leavell and Parry never returned to Ames, permanent replacements had to be found.

The third great impact occurred after the close of the war. Although mention of special training for injured soldiers occurred in September, 1918, no concrete plans appeared till June 1919. (17) On June 16, Henry Giese appeared before the Board of Deans to discuss plans to handle disabled soldiers who wished to take advantage of an federal act providing vocational training for them. Giese, who had been in contact with the St. Louis office of the National Vocational Education Board, estimated the Board might assign 800 to 1000 students to Ames, of whom about 90% might enroll in the non-collegiate work. That group in turn should divide into two large blocks, with about two thirds going into vocational agriculture and one third in trades and industries. (18) As the start of school approached in the fall of 1919, Giese lowered his estimates, projecting about 275 students for Ames, with about 125 students spread over seven business colleges, the other two state schools, and five private colleges. (19) This training for disabled soldiers lasted only a few
months and likely posed severe educational difficulties, for the extension staff had no preparations to meet the problems encountered in rehabilitative work.

The contacts with the Federal Vocational Board did however result in a five year loan of industrial machinery, intended for use by the government students. The almost bizarre arrangement brought four railroad carloads of equipment to Ames, including 22 machine lathes, 12 power grinders, 5 shapers, 4 drill presses, and 4 milling machines. Such excessive amounts of equipment caused at least one observer to speculate on an extensive involvement of the college in retraining for industrial workers. At the time, the Kenyon bill, a proposal of federal funding for retraining men injured in industrial shops, generated the hope that if it passed, "Iowa State College will become a permanent training school and this loaned equipment will remain forever."(20) These hopes for retraining work led to no sustained programs, and through involvement with another temporary effort, helped delay a crucial change facing the extension department, namely its relation with the Smith-Hughes provisions.
Impact of the Smith-Hughes Act

One day after the final approval of the Smith-Hughes Act, two new bills appeared on the floor of the Iowa House of Representatives. One, House File 445, proposed the creation of a state board for vocational education, the other, formal acceptance of the Smith-Hughes provisions. Both bills came to a vote on April 9th, the first passing 69 to 4 and the second 73 to 3. On April 14, both bills went to the Governor, who signed them the same day. According to the new law, the new state board was to consist of three members. Albert M. Deyoe, D. D. Murphy, President of the State Board of Education, and A. L. Urick, Commissioner of Labor, accepted the appointments.

That new board joined the Department of Public Instruction at a time when it strongly advocated the elimination of any overlap in the instructional programs of the state colleges. In 1912, the State Board recommended that in order to eliminate "duplications," all engineering work at the University of Iowa cease, and that home
economics and general science courses taught in Ames should transfer to Iowa City. (24) This proposal caused emotional and sustained opposition from students and faculty in both institutions. After about one year of trying to defend its attack on duplication, the Board accepted a request from the Iowa General Assembly to stop these plans. However, the topic of duplication also appeared in 1915, when a special commission investigated conflicts between Iowa State and the University of Iowa. (25)

This climate encouraged the State Board of Vocational Education to pay little attention to any possible sharing of control with the extension engineers. Apparently, the extension staff did not mount any campaign to win special recognition, but readily accepted the Board as a higher authority. In this respect, Smith did not strive to emulate the extension department in Wisconsin.

In contrast to Iowa, the administration of vocational education for Wisconsin did not fall directly under the State Superintendent of Schools, but rather under the State Board for Vocational Education. The creation of that board stemmed, to a large degree, from the efforts of Reber and his allies. The resulting system of dual control preserved an important role for the engineering extension staff in
Smith had in fact created a system for industrial education in Iowa, but he did not fight to formalize his position. He ceded the new board all authority and needed coaxing to take up any Smith-Hughes work. His first official activity on the act occurred in August, 1917, 6 months after its passage, when he traveled to Washington D.C. to attend a conference about the administration of the act. Smith must have considered missing the conference, for only after Deyoe "strongly urged Mr. Smith to attend...", did he agree to go.(27)

The extension engineers moved from the position of conducting their own independent programs to one of service, almost subservience, to the State Board of Vocational Education rather quickly. In September, 1917, Smith wrote that night classes like those begun by the extension department did not immediately qualify for Smith-Hughes funding, but would "tend to become more and more vocational as times goes on...."(28) Some of the local classes fit easily into the requirements, and over them the extension department lost control quickly. One such class ran in the Curtis Brothers wood-working plant in Clinton, under the leadership of O. H. Johnson from the extension
department, and two other instructors, one an employee of
the company and one a teacher in the Clinton Public
Schools. Instead of continuing under the extension
department, plans provided that the course "be turned over
to the public schools under the Smith-Hughes
vocational education provision" in about one year.(29)

As the Iowa State Board for Vocational Education
developed instruction throughout Iowa, the role for
ingineering extension in Ames grew progressively smaller.
By 1923, this role had shrunk to the level that Harvey
Freeland, supervisor of trade and industrial education,
wrote that the State Board cooperated with the extension
division because "of lack of state funds...."(30) The only
direct instructional work for the staff from engineering
extension concerned foremanship courses.

Starting in the fall of 1921, the extension department
organized conferences for the training of industrial
foremen.(31) During the 1921-22 year, it ran 10 such
conferences, and the following year scheduled 28 courses in
foremanship training.(32) The instructor who provided the
majority of the courses for foremen was Earl Baird, a
member of the extension department.(33) These classes for
foremen became one of the continuing efforts of the
extension work, lasting into the 1960s. Although they
continued for many years, the courses for foremen amounted
to a tiny portion of the programs conducted by the State
Board of Vocational Education and did not serve as a
platform for the leadership of the extension engineers in
the state's vocational efforts.

Teacher Training

Although the State Board took away the vocational
courses, it did assign a new duty to the extension
department, the training of Smith-Hughes teachers. In the
Fall of 1917, the Board ruled vocational teachers under the
Smith-Hughes law had to have a four-year course. Even
though the extension department had no established course,
the Board selected Iowa State as the institution
responsible for the preparation of industrial teachers.
Specifically, the responsibility fell on K. G. Smith, who
had "been given charge of the work in the training of the
teachers in trades and industries." (34) This marked a
shift in Smith's duties, away from diverse extension
programs and into teacher training.

The war interrupted this move toward teacher
education, for within one or two months, Smith left for
service. Apparently, Smith clearly saw the impending decline of engineering extension, for even during his leave of absence for military duty, he began to focus his publications on vocational education and teacher training.(35) During that time, he wrote an article on industrial teachers which appeared in Manual Training Magazine, a publication devoted to secondary teaching.

Not till the fall of 1919 did the college of engineering move to formally establish industrial teacher training. That fall marked the start of the Manual Training, Trades and Industries Department, which consisted of one four year course leading to the degree of Bachelor of Science in Trades and Industries.(36) At the same time, the designation vocational work in engineering disappeared, and the two year courses appeared as offerings in the non-collegiate Trades and Industries Department.(37)

Although the lag in starting that department stemmed to some extent from the war effort, it may have included some resistance from administrators in the college of engineering. Such resistance did occur in several engineering schools. At the AAACES meeting in 1919, J. C. Wright of the Federal Board of Vocational Education delivered a paper, "The Relation of Engineering Departments
of Land-Grant Institutions to the Training of Teachers for Trades and Industries under the Smith-Hughes Act." (38) He laid the responsibility for taking up this teacher training work on the engineering colleges, asserting that he was "impressed with the opportunity of the colleges, with the obligation placed upon the engineering departments of the Land-Grant Colleges and Universities. Many of them possess costly equipment and an adequate corps of well trained technical instructors. ...this matter can not be deferred until tomorrow. These teachers must be found. The engineering institutions are best prepared to manufacture them and the Land-Grant Colleges as a class are, perhaps, best prepared to do this work." (39)

Apparently, some states dragged their feet in assigning teacher training to the colleges of engineering. In the Proceedings for the 34th convention, the following words belied such resistance; "On motion, it was voted that it was the sense of the Executive Body that teacher-training work under the Smith-Hughes Act was one of the most important duties placed upon the land-grant colleges, one which should be shirked by none but be sought and welcomed by all." (40)
Shortly after Smith returned from government service, the influence of the Smith-Hughes act through the State Board of Vocational Education on the extension department became clear. In October, 1919, a report indicated Smith's major responsibility as director of the Trades and Industries department lay in two areas, "collegiate work in Trades and Industries," and "vocational courses in engineering."(41) In order to "give special attention to the preparation of vocational teachers," Smith would "not continue to direct engineering extension work...."(42)

Smith entered into the teacher training work rapidly and began work in the vocational sections of several teachers organizations. In November, 1919, he presented two reports at the annual meeting of the Iowa State Teachers Association, and, in February, he addressed the National Society for Vocational Education.(43) After Smith resigned in August, 1920, he increased his involvement in vocational education, becoming the State Supervisor of Industrial Education in Michigan.(44)

Smith was not the only staff member to leave Ames in the immediate post-war period. Both the Trades and Industries and the Engineering Extension Departments suffered a high rate of turn-over. In September, 1919, two
men joined the extension staff, James M. Early to teach woodworking and James R. Gass, who taught elementary physics. (45) Royal H. Holbrook took a place as the field man for the extension department in February, 1920. (46) In the Trades and Industries Department, several men appeared as part-time instructors in automobile mechanics. As of February, 1920, the mechanics included V. V. Logan, L. E. Puth, and Mr. Chaker and Emerson. (47)

The most critical change in personnel occurred when Adolph Shane replaced Smith as head of Trades and Industries. Shane had taught electrical engineering at Iowa State and completed a degree as Professional Electrical Engineer in 1908. (48) After receiving his degree, he advanced from assistant to associate professor, and worked in Ames till the fall of 1912. (49) In October, 1912 he resigned to become Dean of Engineering at Highland Park College in Des Moines, where he served till he returned to Ames in 1920 as head of both collegiate and non-collegiate Trades and Industries. (50)

When Shane moved to Ames, he brought with him two men from Highland Park, Virgil Gunder who had taught auto mechanics and Harley J. Nethken, a student during Shane's stay in Des Moines. (51) He also hired William H. Flood,
who came from New York and had industrial experience with Westinghouse, Remington Arms Company, and General Motors. (52) Those changes brought an almost totally new staff to the department.

Shane tried to establish a dual purpose in the Trades and Industries department, training of both teachers and industrial supervisors. In January, 1921, he published an article "Trades and Industries Education," in Iowa Engineer. (53) In it he claimed that the four year T&I degree would prepare teachers and administrators for vocational schools, and also prepare students "to assume in due time an important administrative office" in industry. (54)

The notion that the department prepared students for positions in industry survived only a few years. In 1924, the undergraduate program divided into two courses, one in Trades and Industries and the other in Industrial Arts. (55) That schema remained in effect only two years, for in 1926, the department offered only the course in industrial arts, having dropped the course in trades and industries. (56) In recognition of the dominance of teacher education, in December, 1927, the Board of Deans agreed to recommend a name change, replacing Trades and Industries with Industrial Arts. (57)
The vocational courses, which had carried the name non-collegiate work in Trades and Industries since 1919 received a new title, non-collegiate industrial arts, but maintained the established content. The placement of vocational courses within an industrial arts department represented a rather blatant conflict of philosophies, but this confusion lasted only till 1930 when non-collegiate industrial arts no longer had any place in the curriculum. With the elimination of all the vocational courses, which originated in engineering extension before World War I, the industrial arts department totally cut its ties to any direct service to industry.

One indication of this separation occurred in the graduate program, which began in 1922. That year, a graduate minor became available to students seeking a M.S. in agricultural or vocational education. The following year, a graduate degree joined the offerings of the department of Trades and Industries. In 1925, three students completed theses and earned their M.S. degrees. The nature of the research conducted by graduate students up to 1950 has received thorough analysis in a thesis. It documented the devotion of the graduate work to industrial arts education in the secondary schools.
Another indication of the direction of the department occurred in the publications of its leaders. William L. Hunter, who joined the staff in September, 1928, replaced Shane as head of the department in 1931. In contrast to Smith and Shane, Hunter's educational background did not tie him to engineering. He received an undergraduate degree in industrial arts education, a M.S. from the Teachers College of Columbia University and worked toward a Ph.D. at Pennsylvania State College. His publications all concerned industrial arts education.

After Hunter's suicide on May 23, 1939, Lowell Carver joined the staff along with the new department head, T. A. Hippaka. Hippaka received his industrial arts education at the University of Wisconsin and had worked as a director of industrial education in the public schools in Madison. Carver, who completed his M.S. degree in Ames under Hunter, had taught several years in the public schools before coming to Ames. Both began their work in Ames on September 1, 1939. Both devoted their publications to topics of industrial arts education.

Another step removing the department from direct service to industry occurred in 1939. That year, the
department transferred from the engineering division to the agriculture division, to become a part of the vocational education department. Carver described that administrative switch as a "blessing in disguise," for it tied the industrial arts program to the leadership of the "professional educators" in the vocational education department. (69)

The longest lasting link between the engineering extension department and the industrial arts department involved off-campus education courses. With the passage of the Smith-Hughes Act, the extension department terminated its programs for the preparation of rural teachers for manual training instruction. However, in 1920, in cooperation with the State Board for Vocational Education, it re-established a teacher training program. In the fall of 1920, J. V. Lynn of the State Board for Vocational Education took charge of the course for teacher training. (70) In that course, the extension department offered instruction in those cities where "a sufficient number" desired it. (71) The courses so offered included basic education courses, such as trade analysis, organization and administration of industrial education, and techniques of teaching trades. (72) Apparently, Lynn expected some of the engineering graduates to seek teacher
training, for he worked out a plan by which they could complete the education work in one year. (73)

This arrangement in which the extension staff conducted off-campus education classes endured until 1959. (74) Since both the Industrial Arts Department and the Extension Department provided teacher training, the distinction between the departments tended to blur concerning teacher education. Lowell Carver, leader of the department during the late 1950s and 1960s, recalled that he felt some of the extension staff men to be, in practice, part of the industrial arts department, although they received they pay through the extension department. (75)

Not until almost 1960 did the industrial arts department take over the off-campus courses for teachers. Carver remembered the sequence of events leading to that change. The associate director of engineering extension, R. E. Patterson went to Ray J. Bryan, the head of department of vocational education, and said, "I'm going to give you something today." (76) He turned over the off-campus educational work to him. Bryan in turn gave the work to Carver. With this administrative transfer, the extension department eliminated all direct ties with vocational education and teacher preparation. That step
finished cutting the ties between teacher education and extension, leaving the industrial arts department with teacher education, and the extension department with no significant ties to long term educational projects.

Summary

The war effort led the extension department into a number of temporary programs. Once these activities dropped away, working out a response to the Smith-Hughes provisions promoted radical changes. The local vocational courses moved to the control of the State Board for Vocational Education and a new department arose which tried to serve both industry and education. The training for industry died out, leaving the Trades and Industries department with one activity, the preparation of vocational and industrial teachers. The extension department organized fewer and fewer vocational programs, maintaining over a number of years only a few courses for foremen and off-campus teacher training classes. When these functions transferred or disappeared, the engineering extension department exhibited little of its original purpose, that of broad educational service to industry, although it maintained limited programs for years. The Trades and
Industries department became Industrial Arts, and eventually dropped all of the vocational courses begun prior to the war. That left the Industrial Arts department with one mission, teacher training, a goal which dominated its activities up until the last few years.
FOOTNOTES


4. "Bakers' Short Course to Go to Camp Dodge," *Iowa State Student* 43(23) (1 November 1917): 3.


State Student 43(89) (7 May 1918):1.


17. Minutes of the Board of Deans, 24 September 1918.

18. Ibid., 16 June 1919.


22. Ibid., pp. 2220, 2223. These files became chapters 290 and 300 of the Acts and Joint Resolutions Passed at the Regular Assembly of the State of Iowa (Des Moines: State of Iowa, 1917), pp. 315, 336.


25. Ibid., pp. 294-302.


33. Vocational Education Survey III(7) (March 1926).


37. Ibid., pp. 340-348.


39. Ibid., p. 185.


42. Ibid.

43. Kenneth G. Smith, "Some Points On Trade Analysis," *Proceedings of the Sixty-Fifth Annual Session of*
Kenneth G. Smith, "Suggested Developments in Vocational Education for Iowa." This report did not appear in the Proceedings, but received reference on p. 123.


55. Iowa State College Catalog, 1924-25, p. 224.


57. Minutes of the Board of Deans Meeting, 13 December 1927.

58. Iowa State College Catalog, 1928-29, p. 281.

60. *Iowa State College Catalog, 1922-23*, p. 69.


65. Hunter's publications covered a number of years. The following list presents them in chronological order. For simplicity, *Industrial Education Magazine* will be abbreviated *IEM*, *Industrial Arts and Vocational Education* as *IAVE* and *Industrial-Arts Magazine* as *IAM*.


--------, "The Aim of a University," _IEM_ 27(5) (November 1925):140. [Satire]


---------, "A Log," **IEM** 27(8) (February 1926):258. [A poem]

---------, "If the Doctor Should Give Me a Year to Live," **IEM** 27(12) (June 1926):390. [A poem]

---------, "Christmas," **IEM** 28(6) (December 1926):171. [A poem]


---------, "Work," **IEM** 28(9) (March 1927):274. [A poem]


---------, "Industry," **IEM** 29(9) (March 1928):318. [A poem]


---------, "Shop Projects in Cold Iron," **IEM** 31(5)
(November 1929):196-197.

--------, "Guidance in a Large College or University," IAVE 19(7) (July 1930):256-258.


--------, "Ornamental Concrete," IAVE 20(6) (June 1931):225.


Annotated List of Graduate Theses and Dissertations in Industrial Arts and Vocational-Industrial Education Accepted by Institutions of Higher Learning in Iowa (Ames, Iowa State College, 1933). [Mimeographed]

Annotated List of 800 Graduate Theses and Dissertations in Industrial-Arts Education and Vocational-Industrial Education Accepted by Institutions of Higher Learning in the United States, 1892-1933 (Ames, Iowa State College, 1933). [Mimeographed]


"Operating on a Reduced Budget," *IAVE* 22(9) (September 1933): 271-272.


Research Problems and Methods in Industrial Arts Education; A Syllabus and Work Book (Ames, Iowa State College, no date).


--------, "Industrial-Arts Laboratory Planning - I," IAVE 27(3) (March 1938):101-104.

--------, "Industrial-Arts Laboratory Planning - II," IAVE 27(4) (April 1938):137-139.


68. Lowell L. Carver published the following articles in Industrial Arts and Vocational Education.


Thomas A. Hippaka contributed the following publications to Industrial-Arts Magazine [IAM] and Industrial Arts and Vocational Education [IAVE]:


"Planning School Shops," IAVE 38(3) (March 1949):91-


"Survival or Annihilation," IAVE 46(7) (September 1957):205-208.

69. Interview with Lowell Carver, 4 January 1985.


71. Iowa State College Catalog, 1921-22, p. 254.


74. The college catalog for 1957-59 included vocational-industrial teacher training as a portion of engineering extension, p. 255. The next catalog, for 1959-61 contained no mention of teacher training in engineering extension.

75. Interview with Lowell Carver, 4 January 1985.

76. Ibid.
SUMMARY, CONCLUSIONS AND IMPLICATIONS

The purpose of this dissertation was to explore the interrelationship of engineering education and industrial education. It focused on developments at Iowa State College, but also treated national organizations of both engineers and industrial educators. The following summary presents the major findings in condensed form.

Summary

Under the influence of the Morrill Act, land-grant colleges sprang up in many states. In Iowa, the agriculture college in Ames developed a course in mechanic arts, which provided practical training for students intending to pursue industrial careers. Before about 1890, the mechanic arts course amounted to elementary instruction in manual skills, with some additional accompanying theory. The conflicts between the Russian method and the Worcester approach reflected a conflict about the direction in which
engineering education should develop, toward increasing theory or toward high proficiency in skills. During this mechanic arts period, some professors in charge of mechanical engineering sought ways to include students who did not desire a four year degree. Instruction for such non-engineering students amounted to vocational education, an interest which persisted at Ames and other land-grant institutions for many years.

After about 1890, the course in mechanical engineering began to include increasing amounts of engineering theory. In its short period of activity, the mechanic arts section of the AAACES included engineers of two persuasions. Some favored the preservation of extensive shop instruction, which they felt enhanced the employability of college drop-outs as well as graduates. Others felt the shop-work requirements needed restriction, so as to clearly distinguish engineers from mere mechanics. Though the supporters of shop-work had strength in the mechanic arts section, its demise left them with no unique national organization.

The university extension movement, which swept the nation in the early 1890s, included engineers in several states. In the short-lived programs conducted by these
engineers, the potential for technical education beyond the walls of the college appeared great. These prospects also fizzled with the rapid demise of the extension movement. However, in the SPEE, a number of engineers began to seek a role for engineering educators to serve the growing demand for industrial education. J. B. Johnson from Madison led the way in SPEE, and under his influence, the Committee on Industrial Education began its investigations. He also established the school for artisans at Madison, in which the engineering professors provided instruction for industrial workers. This school survived until the reorganization of university extension in Wisconsin in 1905. When L. E. Reber took control of extension, the engineering aspect of the program grew dramatically and began to provide vocational instruction to large numbers of workers and youths. In Wisconsin, Reber and his staff joined the extension concept to the need for industrial education, creating a new educational form, that of engineering extension.

This form attracted the attention of engineers in several of the land-grant institutions, and in 1912, the support of the Iowa Manufacturers Association helped win funding for a department of engineering extension in Ames. This new department transplanted the philosophy and some
staff members from Wisconsin, and established a dynamic program in the years prior to World War I. The extension engineers in Iowa involved thousands in lectures, vocational courses, short courses, and a host of other attempts to carry the university to the people. During the same years, the Land Grant College Engineering Association won admission to the AAACES, and identified engineering extension as one of its two main concerns. To coordinate the efforts of university extension, the National University Extension Association organized, providing yet another forum for engineering extension.

The combined impact of the Smith-Hughes act and the war brought to a halt the national rise of engineering extension. Though the National University Extension Association continued to function, the engineers played a decreasing role after the war. In Iowa, the vocational courses transferred to the control of the State Board for Vocational Education, an organ created by the Smith-Hughes provisions. The Trades and Industries department, which began in 1919, diminished the extension department further. K. G. Smith, who served a head of the engineering extension department since its founding, took charge of the Trades and Industries department and relinquished his control over extension. Instead of devoting his efforts to a wide range
of educational programs, he focused chiefly on teacher education. Though that department tried to preserve some claims to training men for industrial positions, by 1926, it offered only teacher training. In 1930, the two year vocational courses begun at the inception of engineering extension also departed from the Industrial Arts department, marking the last remnant of the vocational aspect of engineering extension. The extension department continues to provide short courses and sporadic publications even today, but in comparison to its activities just before World War I, it has lost its intention of educational service to large numbers of Iowa's industrial workforce. The upshot of these changes left the Industrial Arts department with teacher training as its only mission, a goal which characterized the department for many decades. Only recently has the teacher education option become a minor portion of its work, and the rise of the industrial option has again raised questions about the relation of the department to the college of engineering.

Conclusions

This study suggests several conclusions about the development of industrial education. In Iowa, as well as
other states, industrial education and engineering education were deeply intertwined. Many books on the history of industrial and vocational education overlook that relationship or minimize its importance. That oversight has contributed to a widely accepted, but mistaken view.

Many industrial educators feel that industrial education stemmed from Woodward's efforts to establish a manual training school in St. Louis. To a large extent, they have uncritically accepted the views of Charles Bennett as expressed in his famous book, *History of Manual and Industrial Education*. They feel that as other cities emulated the St. Louis model, industrial education was born. That view has validity for industrial education within the public secondary schools, but it does not well describe its development within colleges and universities.

Industrial and vocational education in several colleges, including Iowa State, stemmed directly from engineering extension as exemplified in Madison. Reber deserves more credit than Woodward as the father of industrial education in many colleges. While most faculty members in departments of industrial education have studied Woodward, most have never heard of Reber. That reflects a
deficiency due to the notion it all started in St. Louis.

Within the field of vocational education, a similar notion has been popular, namely that vocational education in America all began in 1917 with the Smith-Hughes Act. That view also overlooks the contribution of engineering educators. Although they did not remain in the forefront of vocational education in Iowa, the extension engineers under Smith’s leadership initiated many of the programs which the secondary schools incorporated.

In contrast to the approach exemplified by Smith, one seeking to create ties between industrial workers and the college of engineering in Ames, the vocational programs under the Smith-Hughes Act tended to separate the college men from the vocational programs in the secondary schools. That separation has fueled criticisms of vocational education, such as those made by Violas, Ellul, and Cohen. Although the engineers did not control American vocational education, they did at least demonstrate an alternative approach, one which claimed to preserve democratic ideals and at the same time provide technical training.
implications

Several topics introduced in this study deserve consideration for further study. More extensive research might reveal exactly how many colleges other than Iowa State displayed the same developmental process. Such research would require archival searches at such institutions as Columbia University, the University of Pennsylvania, and MIT. This type of study might indicate the level of influence Reber and his extension engineers exerted efforts on those schools.

Perhaps the most significant implication concerns the future relations between engineering and industrial education. Ample evidence has demonstrated the intertwining of industrial education and engineering education. That relationship virtually disappeared in the 1920s and 1930s, leaving industrial education with no direct ties to engineering. However, recently several major universities have already established departments of industrial technology within a college of engineering. Among those schools are Purdue University and the
University of Arizona.

The efforts of extension engineers might come to the fore as early examples of a possible relation between the engineering interests and the industrial educators. However, the dominance of the view espoused by Bennett, namely that industrial education should focus on the public schools, stands as a barrier to that development. Perhaps the current crisis in the training of industrial arts teachers may force those educators dedicated to teacher preparation to review their priorities and consider the opportunities for training industrial technologists. It appears that many industrial education departments should be named industrial technology, since the technology students far outnumber the education students. However, the commitment to education is very strong, particularly in those faculty members who have spent years training teachers.

The value of this dissertation may well lie in its demonstration of numerous precedents for close ties between industrial and engineering educators. If present trends continue, those two groups will certainly have to redefine their roles in technical education. If this study of engineering extension can help industrial and
engineering educators to begin or extend cooperative efforts, then it might provide some positive influence on the present development of industrial education.
CHRONOLOGY

March, 1869  Formal inauguration of Iowa Agricultural College, Ames, Iowa.

October, 1870  Construction of the first workshop at IAC.

March, 1871  William B. Anthony hired as professor of mechanics and physics.

Fall, 1872  Alexander Thompson became professor of mechanical engineering.

1877  Thompson instituted training for non-engineers.

Spring, 1884  Norman C. Bassett became head of mechanical engineering.

Fall, 1888  Charles W. Scribner took chair of M.E.

June, 1890  Philadelphia Society for the Extension of University Teaching established.

December, 1890  American Society for the Extension of University Teaching established.

June, 1891  The Mechanical Engineering Teachers Association organized.

November, 1892  The Mechanic Arts Section created in the AAACES.
August, 1893  Formation of the Society for the Promotion of Engineering Education.

1898  John B. Johnson served as president of SPEE.

December, 1899  Milton P. Higgins presented his first paper on industrial education at ASME meeting.

July, 1900  First report of the Committee On industrial Education in SPEE.

July, 1901  First session of the Summer School for Apprentices and Artisans at the University of Wisconsin.

Fall, 1903  Opening of a school for foremen at the Lowell Institute, MIT.

November, 1903  Mechanic Arts Section of AAACES disbanded.

June, 1905  First summer school for artisans at the Agricultural College of Michigan.

June, 1905  First summer school for artisans at the State College of Kentucky.

June, 1905  Fifth and final summer school for artisans at the University of Wisconsin.

October, 1906  Extension Division created at the University of Wisconsin.
November, 1906  
Evening technical courses started by Columbia University.

September, 1907  
Louis E. Reber appointed head of extension in Madison.

June, 1908  
ISMA convention raised the topic of industrial education.

February, 1909  
Lincoln Steffens wrote about extension in Wisconsin.

November, 1909  
Kenneth G. Smith began work with engineering extension department of University of Wisconsin.

January, 1911  

October, 1911  
Last report of the Committee On Industrial Education of the SPEE.

January, 1912  
Organization of the Land Grant College Engineering Association.

March, 1912  
Anson Marston published plan for industrial education in Iowa.

April, 1912  
Fred H. Rindge spoke at ISC about the YMCA's industrial service work.

May, 1912  
ISMA convention focused on promoting industrial education.

April, 1913  
Iowa General Assembly approves funding
for engineering extension department.

July, 1913  Kenneth G. Smith appointed head of engineering extension at ISC.

March, 1915 Organization of the National University Extension Association.

February, 1917 Final approval of the Smith-Hughes Act.

April, 1917 The United States entered World War I.

April, 1917 Iowa General Assembly accepted Smith-Hughes provisions and created a State board for Vocational Education.

Fall, 1919 Trades and Industries Department started at ISC.

Fall, 1920 Adolph Shane appointed head of the Trades and Industries department.

December, 1927 Name of Trades and Industries department changed to Industrial Arts.
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