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2017

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UNIVERSITY OF CALIFORNIA

Los Angeles

Science Education in Early California Colleges,

1850-1880

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in History

by

Michael Brett Weismeyer

2017

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ABSTRACT OF THE DISSERTATION

Science Education in Early California Colleges,

1850-1880

by

Michael Brett Weismeyer

Doctor of Philosophy in History

University of California, Los Angeles, 2017

Professor Theodore M. Porter, Chair

Higher education institutions in California worked to make the state more prosperous through the science taught and conducted in these institutions during the state's first three decades. This dissertation examines the role of science in these early California colleges and how they interacted with the state's political economy. The colleges founded in this period worked to provide an education that students would recognize as leading to good jobs. While many of these schools were religiously affiliated, the institutions needed students regardless of their religious background in order for the schools to survive.

These early colleges were able to provide services both to students and to the state in general as they reached the public through various means. These included utilizing scientific equipment for conducting experiments and analyzing mineral ores and illustrating scientific concepts with collections of animals, plants, and minerals. Additionally, lectures and public

demonstrations brought science to a wider audience and helped to financially support the schools. Jesuit schools Santa Clara College and St. Ignatius College engaged with areas of mining, agriculture, and electricity. Protestant schools, such as the University of the Pacific and the College of California, also emphasized scientific education, including teaching it to women. The state's healthcare infrastructure was strengthened by the start of medical education in the state with the University of the Pacific's medical department and the Toland Medical College. Future teachers of California's children were taught science in the California State Normal School. The federal Morrill Act's passage allowed California the financial resources to establish a land grant institution, and the University of California was founded with a curriculum emphasizing mining, mechanic arts, agriculture, and engineering.

The dissertation relies on archival sources—such as catalogues, diaries, and board meeting minutes—that are generally located on the present-day campuses of these institutions. Analysis of these documents provides evidence of how these institutions, through their science education, helped California's economy to prosper.

The dissertation of Michael Brett Weismeyer is approved.

Janice L. Reiff

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Theodore M. Porter, Committee Chair

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2017

Dedicated to my family, Richard, Carol, and Marci

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Acknowledgments

In writing this dissertation, I have been aided by the support by numerous individuals. These few words below cannot adequately thank them properly or can include everyone that should be thanked, but I want to express my appreciation to several individuals.

First, I want to thank my many teachers over the years, including at all of the previous institutions I attended, who have honed my research and writing skills. Of particular note are members of my committee, Ted Porter, Jan Reiff, Norton Wise, and Mary Yeager. As my advisor during my time at UCLA, Ted Porter has been an enormous source of help and guidance. During my doctoral journey, I have been aided by other UCLA professors, including Amir Alexander, Soraya de Chadarevian, Sol Cohen, Ellen Dubois, Bob Frank, Mary Terrall, Sharon Traweek, and Rick Wagoner. I valued discussing with and learning from my fellow history of science graduate students, Lino Camprubi, Aimee Dowl, Bradley Fidler, and Adam Lawrence, and gained perspective on my project from Courtenay Raia. My writing was greatly strengthened through the insightful comments by Sergio Figueiredo. Through working together in YRL and numerous lunchtime conversations, Greg Pierce helped the dissertation process be a more enjoyable one.

My research would not have been possible without the assistance of archivists and librarians at several institutions, including the California Historical Society; the California Jesuit Archives; the California State Archives; the California State Library; the Mechanics' Institute of San Francisco; San Jose State University; Santa Clara University; the University of California, Berkeley; the University of California, Los Angeles; and the University of the Pacific. I am grateful for the funding from the UCLA Department of History and the History of Science field. The staff of the UCLA Department of History has been very responsive in whatever way they could assist me. Other departments and areas of UCLA have also been helpful in my overall time

at UCLA, and I am thankful for the many resources that UCLA has to aid graduate students in their progress. I have also been encouraged by various staff, administrators, and other fellow students over the years.

Finally, I want to recognize relatives and friends not associated with UCLA. I especially want to thank my immediate family members, who have always been there for me. My late father, Richard Weismeyer, had an incredible work ethic and provided more assistance throughout my schooling than I can remember. Marci Weismeyer, my sister, has been a truly invaluable help in proofreading and asking questions from an outsider perspective. My mother, Carol Weismeyer, has been my best supporter and proofreader and a constant source of encouragement and someone I could always turn to. This journey has been made better though the help of all of these individuals.

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Chapter 1

Educational Reform in Nineteenth-Century America and Higher Education and Political Economy of the New State of California

Introduction

California in 1850 was a new state, one with fortune hunters filled with dreams of striking it rich in the Gold Rush. While for most these dreams would go unfulfilled, the waves of immigrants brought about developments in the state's political economy. Cities, like San Francisco, grew as the population spread not just in the mining fields but throughout the San Francisco Bay Area and beyond. Agriculture became increasingly important to California's prosperity, and businesses and infrastructure rose to meet the demands of the growing populace. Adding to the indigenous Native American population and those inhabitants from the Spanish and Mexican eras, Americans, as well as individuals from other parts of the world, came to the western edge of the United States to not only look for gold but to settle in America's newest outpost of opportunity.

It was in this environment that the first two colleges in California were founded in 1851. Grade schools had been present in the region well before Americans took control of California, but it was at the 1849 California Constitutional Convention that the idea of higher education was seriously considered. Although a state university took nearly two decades to be established, fairly quickly private colleges began to offer advanced education. Most of these first colleges were sponsored by a religious group, be it one or two denominations or a Catholic religious order. Regardless of their religious affiliation, these schools interacted with the political economy and contributed to the development of the state. Whether the motives of the founders were altruistic,

opportunistic, or some combination of both, California colleges played a role in the state's first decades. Mining, agriculture, and electrification were areas of early involvement. Colleges also began to provide locally trained doctors and teachers, adding to the general development of the state. When a state university was finally created, educational opportunities and research that would benefit the local economy further increased. Within the various colleges and during the first decades, science and technology had important places in both the state and the schools. Science and its applications in the realms of industry and healthcare found a place in the teaching and related work of the college professors. Their students would go on to contribute to California's development.

Of course, what happened in California's early colleges did not occur in a vacuum. Educational reforms and changes in the political economy with industrialization and urbanization were taking place throughout the country. While on the western side of the continent, the experience in California in regards to higher education was connected with what was occurring in the rest of the nation. From early in the nineteenth century, reformers sought to improve education from the earliest grades through college. New conceptions of the purpose and method of schooling were advocated for, and the rationale and educational offerings of higher education institutions were debated and modified.

This dissertation examines the specific case of how science education in early California colleges was conducted and the ways in which these colleges, through their science, worked to promote the political economy of the state. These colleges needed to attract and keep students, and this economic reality shaped decisions that the college leaders made. The outcomes of these decisions and the ways that science was part of what the colleges did is a major theme of the dissertation. As will be shown, many of the educational leaders stated publicly how they viewed

the role of higher education in California and how they believed that higher education and science could contribute to the state's development. These individuals expressed ambitions to shape the new state through their colleges, and science and its applications was often at the center of how this could and should be accomplished, according to them. Likewise, as California developed and new needs and demands arose, the educational landscape of California changed as well.

The scope of this dissertation is geographically focused on California, and more specifically in the San Francisco Bay Area, and the period examined is from just before statehood until about 1880. Both religious and public colleges are examined. These schools educated individuals for a variety of professions and some schools specialized in the training of doctors and teachers. Although what happened in these educational institutions was responding directly to conditions in Californian, this California story needs to be understood through the national context and the state of the nation's political economy during the nineteenth century.

National Educational Context

Education was important in the development of the United States and thus the political economy of the nation. Industrialization was occurring, and education became important in assisting America's development. With industrialization becoming more prevalent in society, better trained workers, who had a deeper understanding of societal issues, were needed.¹ From

¹Dickson A. Mungazi, *The Evolution of Educational Theory in the United States* (Westport, CT: Praeger Publishers, 1999), 95.

the early nineteenth century, such workers were trained through industrial education.² Most individuals received at least an elementary education that taught basic knowledge and the values that American leaders advocated. At the same time, while relatively few individuals studied in a college or university, a trend was developing that would place a premium on such an education. Higher education provided a basis for the economic development of the country as it furnished a means for a greater dissemination of knowledge and skills. Francis Wayland, Herbert Spencer, and Charles Eliot were three figures in higher education in this period. While there is no direct evidence linking any of them to California's colleges, their stories are instructive for how higher education in the United States was being shaped throughout the nineteenth century and provides a basis for placing what occurred in California's early colleges in the national context.

Francis Wayland was a prominent educator who recognized education's potential role in industrialization. During his tenure as Brown University's president from 1827 to 1855, he proposed educational reforms based on his understanding of New England's political economy that he envisioned would spur commercial and industrial development and the growth of political freedom. Through his proposals, Wayland developed a broad basis for what the industrializing nation needed: an educated populace. Wayland observed that with these developments came a need for individuals with specialized education.³ He noted, "it is manifest to the most casual observer that the movement of civilization is precisely in the line of the useful arts. Steam, machines and commerce, have built up a class of society which formerly was only of secondary

²Warren Button and Eugene F. Provenzo Jr., *History of Education and Culture in America* (Englewood Cliffs, NJ: Prentice-Hall, 1983), 157.

³Lawrence A. Cremin, *American Education: The National Experience, 1783-1876* (New York: Harper & Row, 1980), 273-276.

importance. The inducements to enter the learned professions have become far less, and those to enter upon the active professions, vastly greater.”⁴ Furthermore, he advocated an educational system that would allow individuals to obtain an education that would be of most use in their own work. He decried education in Europe and the United States that prepared students for “the learned professions (law, medicine, divinity, and teaching)” while ignoring the needs of many others that would enter industrial professions.⁵ One of his suggestions for reform involved a dramatic change in college curriculum. Instead of having all students go through the traditional curriculum of the classics, mathematics, and natural and moral philosophy at the same pace, he recommended adding curricular choices for students. Besides the traditional subjects, he suggested adding “work in chemistry, physics, and geology, English language and rhetoric, political economy, history, law, the science of teaching, the principles of agriculture, the application of chemistry to the arts, and the application of science to the arts.”⁶ Thus, Wayland hoped to expand the curriculum to encompass what all societal classes needed intellectually.⁷ Science, he saw, ought to be a major component of this educational reform. Wayland’s call for change came in 1850, one year before the first California colleges were established. While generally these schools began in the mold of the traditional educational system, they changed to reflect the national trend and the needs of the state. Although there is no direct evidence of

⁴[Francis Wayland], *Report to the Corporation of Brown University on Changes in the System of Collegiate Education* (Providence, RI: George H. Whitney, 1850), 21; quoted in Cremin, 276.

⁵Cremin, 277.

⁶Ibid.

⁷Ibid., 278.

educators in California using Wayland's ideas as a basis for their changes, it is not improbable that these educators, many—if not most—of whom were educated in colleges in the eastern United States, would have been aware of what Wayland was undertaking at Brown.

Wayland's call for reform came as technological applications of science were increasingly taking place. One example from the 1876 Philadelphia Centennial Exhibition illustrates the prominence of technology as machines took center stage. Of all the machines at the exhibition, the Corliss steam engine was the most prominent of all. It weighed 700 tons and was forty feet high, making it the largest engine in the world and capable of outputting 2,500 horsepower at thirty-six revolutions per minute. This allowed it to provide power for the 1,400-foot long Machinery Hall. This massive engine provided a visual demonstration to Americans that machines had become intensely important.⁸ At the same time, scientific and technological knowledge increased as colleges and universities made curricular changes that provided the type of education needed.

This all occurred as the United States was growing in population, and as society had become more complex and diverse, beliefs and values changed as well.⁹ Spurred on by Manifest Destiny and hopes of striking it rich, the United States now stretched to the Pacific Ocean as Americans moved westward. Steamboat and railroad travel became means of transportation for both goods and people and aided in the geographic expansion of the nation. America had gone from a primarily rural nation to one in which industry and machinery had become woven into the country's fabric. Scientific and technical education enabled this to occur.

⁸Button and Provenzo, 47.

⁹Ibid.

How science should be incorporated into education was a topic that was taken up by not only Americans, like Francis Wayland, but also Europeans like Herbert Spencer, one of the major thinkers of the mid-1800s who strongly felt that science should have a preeminent place in education. Although perhaps best known today for his promotion of social Darwinism and coining of the term “survival of the fittest,” he also wrote on a variety of scientific and philosophical issues. In doing so, as Americans confronted new scientific, religious, and philosophical ideas, he aided them through direct consideration of these issues in an educational context through his books on these subjects. An Englishman, Spencer published his first book in the United States not on philosophy or science directly but on education. First published in 1860, it was titled *Education: Intellectual, Moral, and Physical*.¹⁰ The book contained four essays that together were likely the most read of his works in either the United States or Europe.¹¹ One reason for this, at least in the United States, was the promotion of Spencer’s work by Edward Livingston Youmans, a textbook author. Youmans was a business associate of William Appleton, a publisher, who helped Youmans publish Spencer’s book in the United States.¹²

However, another reason existed for Spencer’s American popularity. Historian of education Lawrence Cremin summarizes some of the factors that led to Spencer’s widespread appeal. Cremin argues that following the Civil War, industrialization and urbanization brought

¹⁰Andreas M. Kazamias, “Herbert Spencer: Prophet of Individualism and Scientific Culture,” in *Herbert Spencer on Education*, ed. Andreas M. Kazamias (New York: Teachers College Press, Columbia University, 1966), 2, 6, 51. Spencer lived from 1820 to 1903.

¹¹Lawrence A. Cremin, foreword to Kazamias, *Herbert Spencer on Education*, vii.

¹²Cremin, *American Education: The Metropolitan Experience, 1876-1980* (New York: Harper & Row, 1988), 387-388. Youmans helped Spencer’s writing to be featured in publications such as *Popular Science Monthly*. Additionally, Youmans was Spencer’s host during Spencer’s 1882 United States visit.

about social disruptions. Americans also began to question how to reconcile Christian beliefs and scientific knowledge based on what they were learning of Darwin's theory of evolution. Spencer provided a way to bring together religion and science by claiming that scientists would not be able to learn something about the world that would breach the domain of religion.¹³ He thus helped Americans think about some of the most important philosophical, scientific, and religious ideas of the day. These type of ideas were also the ones that higher education addressed, especially in religiously-affiliated colleges and universities.

In *Education: Intellectual, Moral, and Physical*, Spencer began by asking the question "What knowledge is of most worth?" In fact, he devoted the first chapter to this question, with the question serving as title. Throughout the chapter, he discussed the role of education and his philosophy of education. At the end of the chapter he directly answered his title question with a one word answer, "Science."

Spencer viewed science as the knowledge needed for "direct self-preservation, or the maintenance of life and health," for "gaining a livelihood," for providing "the proper guidance" for parenting, and for providing "the indispensable key" for understanding national life, allowing citizens to have their conduct "regulated."¹⁴ Producing and enjoying art in whatever form would come as a result of being prepared by science. Finally, Spencer argued that studying science is the most efficient way of gaining intellectual, moral, and religious discipline.¹⁵ Like Wayland a decade earlier, Spencer even more emphatically viewed science as the answer to all of life's

¹³Ibid., 388-389.

¹⁴Herbert Spencer, *Education: Intellectual, Moral, and Physical* (London: John Childs and Son, 1861), 53.

¹⁵Ibid.

questions and certainly as the basis for education. As an educational foundation, science could, in his view, be a unifying aspect of the common schools. Likewise, science ought to rightly play a major role in higher education. Through the range of educational institutions, science could provide a driver for the political economy and help spur further industrialization.

Spencer spent much of his first chapter discussing what he viewed as “science” as well as the disciplines that were part of science. Besides giving examples of how a particular discipline was and ought to be useful, he critiqued at times the ways the discipline was currently being utilized. Most of the disciplines he listed would be ones commonly thought of as scientific. For example, he mentioned mathematics and its associated sub-disciplines like mensuration, geometry, and mechanics. He then discussed physics and heat, light, electricity, and magnetism, before he turned to chemistry and uses with ores, fermentation, soil analysis, and manufacturing. Biology was his next subject and along with it agriculture and physiology. The “Science of Society” received attention next, in which he included understanding supply and demand and the laws of commercial activities. Spencer again mentioned physiology, this time with psychology, as being important scientific knowledge for the “laws of life.” Next, he included history in his list of disciplines and aspects that today might be termed political science and economics. Finally, while not adding on additional disciplines, Spencer noted that art, music, and literature all needed science as a basis for their fulfillment.¹⁶ Spencer’s fairly comprehensive list of scientific disciplines provided him with the basis for answering the question of the knowledge with the most worth and what should be included in a good educational curriculum.

Spencer’s adamant belief in the role for science in education came at a time of debate on

¹⁶Ibid., 18-23, 31-46. Spencer argued that history was generally not properly studied or taught. Instead, he contended that students should study the “natural history of society.”

the topic. John Stuart Mill noted, “The great controversy of the present day is the vexed question between the ancient languages and the modern sciences and arts; whether general education should be classical—let me use a wider expression, and say literary—or scientific.”¹⁷ As the nineteenth century continued, educators proceeded to consider the role of science in education. They would also keep drawing upon Spencer for ideas.

While it is not known whether the education leaders in California read Spencer’s *Education*, his ideas were certainly circulating among education circles. Among those turning to Herbert Spencer was Charles Eliot, one of the later nineteenth century’s most important educators and president of Harvard University for forty years beginning in 1869.¹⁸ While not going as far as Spencer had done in making science the primary basis for education, Eliot did promote science in his own work and drew upon Spencer.¹⁹

When Eliot wrote an introduction to a later edition of Spencer’s *Education*, he linked Spencer’s ideas on education and science to the political economy. Eliot noted that “modern

¹⁷John Stuart Mill, *Inaugural Address Delivered to the University of St. Andrews, February 1, 1867* (Boston: Littell and Gray, 1867), 5; quoted in Kazamias, *Herbert Spencer on Education*, 27.

¹⁸Eliot also was involved with numerous other educational and public activities. For instance, he worked with other university presidents, headed the National Education Association’s Committee of Ten on Secondary School Studies and wrote its report, and was involved with the College Entrance Examination Board, the General Education Board, the Carnegie Endowment for International Peace, and the Carnegie Foundation for the Advancement of Teaching. Eliot also advised Woodrow Wilson, the United States Senate, and the Chinese government. For the general public, he was famous for his “Five-Foot Shelf” that contained fifty-some books that he felt were something of a substitute for a good liberal education. Cremin, *The Metropolitan Experience*, 379, 385-386.

¹⁹Henry James, *Charles William Eliot: President of Harvard University, 1869-1909*, vol. 1 (Boston: Houghton Mifflin Company, 1930), 349-351. The American publication of Spencer’s book *Education* came just as Eliot was working to make science more useful to his students. Eliot utilized Spencer’s ideas by helping him better articulate his own ideas.

industrial and social conditions compel the preparation in science of young people destined for various occupations and services indispensable to modern society. . . . and that [with more science instruction] a greater number and variety of young men will be prepared . . . for the service of the nation.”²⁰ Additionally, he wrote that Spencer’s ideas had “been floated on a prodigious tide of industrial and social change, which necessarily involved widespread and profound educational reform.”²¹ Eliot, thus, regarded Spencer as having contributed much to the education discussion and to the way educational institutions interacted with political economy.

Focus and Scope of the Dissertation

From this broader, national context, this dissertation examines specifically a number of California institutions primarily during the period of 1850 to 1880, including the following: Santa Clara College (now Santa Clara University), St. Ignatius College (now the University of San Francisco), the University of the Pacific, the Toland Medical College, the California State Normal School (now San Jose State University), the College of California, and the University of California (now the University of California, Berkeley). All of them, during the period of this dissertation, were located in the San Francisco Bay Area, specifically in Santa Clara, San Francisco, San Jose, and Oakland.

The dissertation’s starting date of 1850 coincides with California statehood followed by the first two colleges being founded in 1851. Examining thirty years to 1880 was not an artificial end date but rather indicates a period where each of the schools in the dissertation developed for

²⁰Charles W. Eliot, introduction to *Essays on Education and Kindred Subjects*, by Herbert Spencer (New York: E. P. Dutton & Co., 1910), x, xvi.

²¹*Ibid.*, xvii.

at least a decade as they faced decisions on their direction and sometimes existential questions regarding their own continued survival or that of various degrees and programs. Also, by the 1880s, the population of California was reaching a point where many other colleges and universities began to be founded throughout the state, including in southern California. Finally, a new state constitution was adopted in 1879 so that this dissertation examines almost exclusively the time during which the original state constitution was in effect. The three decades studied provide insights into how California was developing as a state and the role that the colleges included contributed to the political economy through their science education.

This dissertation aims to add to the understanding of these early years of California state history. Much has been written on the Gold Rush and first years of the state, including literature on education in California. Through examination of the colleges in the dissertation, I will add to the historiography by contributing new insights into how colleges specifically contributed to California's political economy through the science and technology that was taught and conducted in these institutions. Furthermore, for many of the colleges contained in this dissertation only institutional histories exist with little other literature that deals with their development in connection to the state and its political economy. While almost all of the colleges have survived to the present, most of them, in general the private ones, have not received much notice due to their relatively small size and seemingly less importance in the higher education realm. This research, thus, considers the contribution of these less well-known schools as well as the role of the state-sponsored institutions. While this dissertation has drawn upon a number of historians (many of which are discussed later in this chapter as well as in the subsequent chapters), I highlight new areas of research that specifically address the role of these colleges in the economic development of California.

The rest of this chapter outlines relevant literature on higher education in the nineteenth century United States. It also examines literature on California in the first decades of statehood as well as providing historical context on the political economy of the state. Additionally, the beginnings of higher education, and specifically religious colleges, in California is discussed.

Chapter two focuses primarily on Santa Clara College, founded in 1851, but also includes St. Ignatius College, founded in 1855. Both institutions shared characteristics, including that both were Jesuit colleges that admitted only male students and faculty often taught at one college before transferring to the other. Santa Clara College boasted in its catalogues of the scientific equipment that it possessed, and some of this equipment was utilized for metallurgy and assaying purposes. One particularly useful source for this chapter was a diary kept by a student, who described many of the science classes he took as well as interactions he had with professors in conducting technical procedures related to mining. A number of the professors were accomplished in scientific fields and contributed to society, such as through discussions of agriculture and applications of electricity. What role science should have in these schools was at times debated with the Jesuit superiors in Europe.

The third chapter focuses on the University of the Pacific, a Methodist institution founded in 1851, and its medical school, which, founded in 1859, was the first such institution in California. Unlike the Jesuit schools, the University of the Pacific admitted both males and females, and from early in its history the school taught females scientific concepts similar to what was taught to males. While like Santa Clara College the University of the Pacific was located in Santa Clara, the state's first medical school was established in San Francisco. A few years after the medical department of the University of the Pacific was founded, the Toland Medical College was established. Both schools were involved with medical journals and worked to improve and

shape California medical education and treat ailments that were believed to be unique or more common in the state. Eventually, the Toland Medical College became part of the University of California, while the University of the Pacific's medical department first joined another college, then became an independent school, before becoming the medical school for Stanford University.

The California State Normal School is the subject of the fourth chapter. Throughout the 1850s and 1860s, the number of students and grade schools in California rapidly increased. This was also the period when the education reformers were building upon the system of common schools with the establishment of normal schools and teachers' institutes for the better training of teachers. Founded in 1862 in San Francisco, the California State Normal School began small but by the time it moved to San Jose in the following decade, it had begun to have a sizeable student body. While the science education done at the school may not have been as in-depth as other colleges, the reach of that education would be extended throughout the state as graduates of the normal school went on to teach the state's children. Science education at the normal school emphasized flora and fauna common to California as well as experiments and lessons that would aid in the lives of the state's people.

The final chapter discusses the College of California, founded in 1853, and the University of California, founded in 1868. The College of California was the result of collaboration between Congregationalists and Presbyterians and was located in Oakland. It attempted in the 1860s to have a greater emphasis on mining education. However, for various reasons this did not succeed as the leaders would have liked. Around the same time in 1862, the Morrill Act passed in the United State Congress. This law paved the way for something that had been discussed in California since the state's constitutional convention in 1849—the creation of a state university. With the College of California struggling to survive, its board offered the campus (and

essentially its faculty and president) to the state to begin the University of California. Following the conditions of the Morrill Act, the University of California created schools and programs for agriculture and mechanic arts as well as for mining and engineering, all of which corresponded with business interests in the state.

Higher Education Historiography

Throughout the nineteenth century, American higher education underwent changes as it adapted to larger developments in the nation. Higher education in this period has been discussed by a number of historians, including ones from decades ago whose work is still important for the factual content or the arguments that continue to provide a basis for history of education.

Providing an overarching and encyclopedic survey of the history of education are works by Lawrence Cremin. His three-volume series, *American Education*, covers the history of American education from 1607 to 1980.²² These volumes contain background information and quoted sources concerning education from the earliest grades through university level. The breadth of his documentation furnishes a starting basis for more in-depth works.

Some works include a focus on the history of pre-collegiate education. These histories can be important not only in their own right but also as they provide an understanding of the preparation college students had as well as the general educational conditions in the country. Additionally, for graduates of normal schools, this history describes the types of schools they taught in and the type of curriculum they taught.

²²Lawrence A. Cremin, *American Education: The Colonial Experience, 1607-1783* (New York: Harper & Row, 1970); Cremin, *American Education: The National Experience, 1783-1876* (New York: Harper & Row, 1980); and Cremin, *American Education: The Metropolitan Experience, 1876-1980* (New York: Harper & Row, 1988).

One useful history of grade school education is Joel Spring's *The American School*.

While the scope of his book goes from colonial times to the present, one particularly useful part is his examination of the common school movement. The common school movement arose during the 1830s and 1840s and spread throughout the country, affecting education including that in California. As Spring describes it, the common school movement contained three main features. First, the term "common school" came from all children being educated in the same building as a way of lessening tensions among various social groups. This brought together individuals from diverse backgrounds that might not otherwise have associated with each other. Second, schools became a means of government policy in an effort to solve problems—be they social, economic, or political. Here schools contributed to the nation through developing citizens, building upon common ideals, and increasing social cohesion to name three. Finally, the common school movement created state agencies to oversee local schools.²³ The common school movement helped education become an important force in nineteenth century America. Additionally, characteristics of the common school movement were seen in higher education institutions as well.

Another book that looks at the common school movement from its origins is *The American Teacher* by Johanna Lemlech and Merle Marks. Their work is not as comprehensive in time as is Spring's. However, it focuses on other aspects such as specifically the ways teachers operated in American schools. Teaching strategies are included as well as some information on

²³Joel Spring, *The American School: 1642-2004*, 6th ed. (Boston: McGraw-Hill, 2005), 73-75.

early schools in California from the Spanish and Mexican days into the United States period.²⁴

Other books examine the pre-college educational landscape.²⁵ Additionally, other works address textbooks. Textbooks can be useful and important means for understanding what was actually taught in classrooms, since few lesson plans from the era exist.²⁶

Turning to higher education history, a number of works examine higher education either in part or in whole. Some are broader, more comprehensive texts.²⁷ Examining the theoretical side of education is Dickson Mungazi's *The Evolution of Educational Theory in the United States*. Mungazi argues that education was called upon to assist America's development as industrialization became more integral to the United States. Changes associated with the Industrial Revolution necessitated the need for better trained workers, and the knowledge of

²⁴Johanna Kasin Lemlech and Merle B. Marks, *The American Teacher, 1776-1976* (Bloomington, IN: Phi Delta Kappa Educational Foundation, 1976).

²⁵Such books include the following: Warren Button and Eugene F. Provenzo Jr., *History of Education and Culture in America* (Englewood Cliffs, NJ: Prentice-Hall, 1983); Theodore R.Sizer, *Secondary Schools at the Turn of the Century* (New Haven, CT: Yale University Press, 1964); Diane Ravitch, *Left Back: A Century of Battles over School Reform* (New York: Touchstone, 2000); and William J. Reese, *The Origins of the American High School* (New Haven, CT: Yale University Press, 1995).

²⁶Focusing on secondary textbooks is Ruth Miller Elson, *Guardians of Tradition: American Schoolbooks of the Nineteenth Century* (Lincoln: University of Nebraska Press, 1964). Pre-collegiate and collegiate texts as well as biographies of authors can be found in Charles Carpenter, *History of American Schoolbooks* (Philadelphia: University of Pennsylvania Press, 1963). Educational administration texts are examined in Thomas E. Glass with Robert Mason, William Eaton, James C. Parker, and Fred D. Carver, *The History of Educational Administration Viewed through Its Textbooks* (Lanham, MD: Scarecrow Education, 2004).

²⁷More prominent texts include the following: Arthur M. Cohen, *The Shaping of American Higher Education: Emergence and Growth of the Contemporary System* (San Francisco: Jossey-Bass Publishers, 1998); John R. Thelin, *A History of American Higher Education* (Baltimore, MD: Johns Hopkins University Press, 2004); and Frederick Rudolph, *The American College and University: A History*, (New York: Knopf, 1962; repr., Athens: University of Georgia Press, 1990).

societal issues that higher education could provide was needed.²⁸ Brian Pusser also considers higher education from a theoretical standpoint. In a chapter in an edited volume, Pusser provides both historical and philosophical arguments regarding education with specific attention to the role of the public good and public spheres. Historically, he looks at changes in education from colonial times to the late twentieth century, while philosophically he takes Jurgen Habermas's concept of the public sphere as a starting point to examine the place of higher education within American society.²⁹ Sol Cohen in *Challenging Orthodoxies* utilizes theory to help understand the history of education. Besides addressing the works of historians like Cremin and the ways the "linguistic turn" affected the history of education, Cohen also analyzes the mental hygiene movement on American education and the idea that science could solve the problems of the nation's students.³⁰

Addressing nineteenth-century colleges specifically, James McLachlan argues that colleges throughout the nineteenth century need to be reappraised by historians. He posits that colleges were not overly elitist, were ethnically diverse and not necessarily dogmatically Protestant, and coexisted and thrived with universities in the latter part of the nineteenth century.³¹ How colleges and universities were able to prosper in the nineteenth century is the

²⁸Dickson A. Mungazi, *The Evolution of Educational Theory in the United States* (Westport, CT: Praeger Publishers, 1999).

²⁹Brian Pusser, "Reconsidering Higher Education and the Public Good: The Role of Public Spheres" in William G. Tierney, editor, *Governance and the Public Good*, Suny Series, Frontiers in Education (Albany: State University of New York Press, 2006).

³⁰Sol Cohen, *Challenging Orthodoxies: Toward a New Cultural History of Education* (New York: P. Lang, 1999).

³¹James McLachlan, "The American College in the Nineteenth Century: Toward a Reappraisal," *Teachers College Record* 80, no. 2 (December 1978): 287-306.

subject of Gunapala Edirisooriya's article examining marketing strategies employed by institutions of higher education. He lists several strategies that he finds evidence for enabling schools to survive. These include free tuition, partnering with high schools, relaxing admissions standards, and legislative initiatives.³² One other article on nineteenth-century colleges is "From the New World to the Old, and Back Again," in which Brian Ingrassia contends European ideas were utilized by American educational reformers, like Francis Wayland and Henry Tappen, to shape education in the United States. However, they did not simply import educational methods and systems from Germany, France, or Great Britain, but adapted them to what Americans needed in the mid-nineteenth century in an effort to help unify the country and promote American democratic ideals.³³

Another book on higher education in the nineteenth century is Mark Nemeč's *Ivory Towers and Nationalist Minds: Universities, Leadership, and the Development of the American State*. A theme that Nemeč formulates is the development of universities following the Civil War and the place that they assumed in American society. As part of this overarching theme, he considers the Morrill Act and how its passage affected the continued development of universities and the ways they served national interests. He specifically uses the University of California as an example of a state concerned with higher education from its start and how the creation of a state university through the Morrill Act could go beyond the specifics of the law in order to better

³²Gunapala Edirisooriya, "A Market Analysis of the Latter Half of the Nineteenth-Century American Education Sector," *History of Education* 38, no. 1 (January 2009): 115-132.

³³Brian M. Ingrassia, "From the New World to the Old, and Back Again," *Journal of the Early Republic* 32, no. 4 (Winter 2012): 667-692. Tappen will be discussed later in this chapter.

provide what was needed by the political economy of the state.³⁴

Roger Geiger is a historian of education that has written extensively on all aspects of higher education in the United States. His works range from a brief overview of higher education to examinations of specific disciplines and their development.³⁵ A single work useful for higher education in the 1800s is his edited volume, *The American College in the Nineteenth Century*. The book includes chapters by various education historians on the development of higher education in the United States throughout the nineteenth century. Among those chapters are ones relating to the rise of denominational colleges and science in higher education.³⁶ One point that Geiger makes is that the denominational college was the primary institution of higher education for a generation following the Civil War. These colleges were not simply static institutions but instead worked to make their programs fit the increasing base of knowledge and changing student

³⁴Mark R. Nemecek, *Ivory Towers and Nationalist Minds: Universities, Leadership, and the Development of the American State* (Ann Arbor: University of Michigan Press, 2006).

³⁵Roger L. Geiger's overview of higher education is "The Ten Generations of American Higher Education," in *American Higher Education in the Twenty-first Century: Social, Political, and Economic Challenges*, 2nd ed., edited by Philip G. Altbach, Robert Oliver Berdahl, and Patricia J. Gumport, 38-70 (Baltimore, MD: Johns Hopkins University Press, 2005); and an examination of the development of social science is found in Geiger's "American Foundations and Academic Social Science, 1945-1960," *Minerva* 26, no. 3 (1988): 315-41. For the development of research universities in the twentieth century see Geiger, *To Advance Knowledge: The Growth of American Research Universities, 1900-1940* (New York: Oxford University Press, 1986); and Geiger, *Research and Relevant Knowledge: American Research Universities since World War II* (New York: Oxford University Press, 1993). Several chapters on the nineteenth century, including on land grant colleges like the University of California is found in Geiger, *The History of American Higher Education: Learning and Culture from the Founding to World War II* (Princeton, NJ: Princeton University Press, 2015).

³⁶Roger L. Geiger, editor, *The American College in the Nineteenth Century*, 1st ed, Vanderbilt Issues in Higher Education (Nashville, TN: Vanderbilt University Press, 2000).

body to prepare individuals with vocational and practical skills needed for new markets.³⁷ This challenges the narrative that has often been held in the traditional historiography that these denominational colleges were not as important in the historical landscape.

Geiger himself is included in an edited volume focusing on land grant colleges. His chapter in *Science as Service*, edited by Alan Marcus, is “Land-Grant Colleges and the Pre-Modern Era of American Higher Education, 1850-1890.” He argues for a reconceptualization of how education historiography has traditionally categorized educational eras in the nineteenth century. Instead, he proposes a new division for “premodern era” institutions that straddle the period on either side of the Civil War rather than having the Civil War be the dividing line for changes in higher education. Geiger proceeds to examine the wide variety of educational institutions that fit into his definition. Among the types of schools he surveys include normal schools, schools of science, multipurpose colleges, medical schools, and polytechnic institutes.³⁸

Several books contextualize science education from the history of science perspective. This is done both by examining the American experience as well as science education in a European setting. For instance, Hunter Dupree’s *Science in the Federal Government* describes the federal government’s interaction with science, including in higher education and the Morrill Act.³⁹ From the European side, Andrew Warwick looks at mathematical physics at Cambridge

³⁷Ibid., 128.

³⁸Roger L. Geiger, “Land-Grant Colleges and the Pre-Modern Era of American Higher Education, 1850-1890” in Alan I. Marcus, editor, *Science as Service: Establishing and Reformulating Land-Grant Universities, 1865-1930* (Tuscaloosa: University of Alabama Press, 2015).

³⁹Hunter Dupree, *Science in the Federal Government* (Cambridge, MA: Belknap Press of Harvard University, 1957; repr., Baltimore, MD: Johns Hopkins University Press, 1986). Other books addressing American education include Patricia Cline Cohen, *A Calculating People: The*

and changes in undergraduate education.⁴⁰ A major work in the history of education literature is *Curriculum* by Frederick Rudolph.⁴¹ It takes the development of curriculum in undergraduate institutions from the founding of Harvard to the early 1970s as its focus. Along the way, Rudolph addresses science's rise in curricular prominence.

Most of the colleges discussed in this dissertation had religious origins, and much literature has been written on the relation of science, religion, and higher education. Some works use research universities or denominational colleges as examples, while others look at specific individuals and ideas.⁴² Still others examine the relationship of specific denominations and religious groups and education.⁴³ One work, whose first chapter deals with the nineteenth century

Spread of Numeracy in Early America (Chicago: University of Chicago Press, 1982); and John C. Greene, *American Science in the Age of Jefferson* (Ames: Iowa State University Press, 1984).

⁴⁰Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (Chicago: University of Chicago Press, 2003). An article addressing French education in shaping American approaches to science in mid-nineteenth-century colleges is A. J. Angulo, "The Polytechnic Comes to America: How French Approaches to Science Instruction Influenced Mid-Nineteenth Century American Higher Education," *History of Science* 50, no. 3 (September 2012): 315-338.

⁴¹Frederick Rudolph, *Curriculum: A History of the American Undergraduate Course of Study Since 1636* (San Francisco: Jossey-Bass Publishers, 1977).

⁴²Some of the more useful works in this area include the following: Julie A. Reuben, *The Making of the Modern University: Intellectual Transformation and the Marginalization of Morality* (Chicago: University of Chicago Press, 1996); Jon H. Roberts and James Turner, *The Sacred and the Secular University* (Princeton, NJ: Princeton University Press, 2000); D. G. Hart, "The Protestant Enlightenment Revisited: Daniel Coit Gilman and the Academic Reforms of the Modern American University," *Journal of Ecclesiastical History* 47, no. 4 (October 1996): 683-703; and Natalie A. Naylor, "The Theological Seminary in the Configuration of American Higher Education: The Ante-bellum Years," *History of Education Quarterly* 17, no. 1 (1977): 17-30.

⁴³Books looking at specific religious groups include the following: James Tunstead Burtchaell, *The Dying of the Light: The Disengagement of Colleges and Universities from their Christian Churches* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 1998); Andrew M. Greeley, *From Backwater to Mainstream: A Profile of Catholic Higher Education* (New York: McGraw-Hill Book Company, 1969); Robert Hassenger, ed., *The Shape of Catholic*

and in particular the relationship between science and religion within higher education, is Douglas Sloan's *Faith and Knowledge: Mainline Protestantism and American Higher Education*. He states that most students were in Christian colleges through the nineteenth century and also looks at the efforts that educators, theologians, and religious writers took to show how science and religion went together without conflict. This included evolution, even if the ideas concerning evolution were not always strictly Darwinian, which might be actually at odds with some religious beliefs. Sloan provides an insight into the changing relationship between science and religion and how higher education played a part in this.⁴⁴

California educational history is chronicled in a number of books.⁴⁵ Although older, several books by William Ferrier remain useful resources as they contain records of documents that have since been lost. Ferrier's works include some specifically on the University of California and one on religious movements and educational institutions in California. His *Ninety Years of Education in California, 1846-1936* is the most comprehensive of his books and is a fairly encyclopedic take on that period of California's educational history.⁴⁶

Higher Education (Chicago: University of Chicago Press, 1967); Manning M. Pattillo Jr. and Donald M. Mackenzie, *Church-Sponsored Higher Education in the United States* (Washington, DC: American Council on Education, 1966); and William C. Ringenberg, *The Christian College: A History of Protestant Higher Education in America* (Grand Rapids, MI: Christian University Press, 1984).

⁴⁴Douglas Sloan, *Faith and Knowledge: Mainline Protestantism and American Higher Education* (Louisville, KY: Westminster John Knox Press, 1994).

⁴⁵Some of the more useful works include Irving G. Hendrick, *California Education: A Brief History* (San Francisco: Boyd & Fraser Publishing Company, 1980); and John Aubrey Douglass, *The California Idea and American Higher Education: 1850 to the 1960 Master Plan* (Stanford, CA: Stanford University Press, 2000).

⁴⁶William Warren Ferrier, *Ninety Years of Education in California, 1846-1936: A Presentation of Educational Movements and their Outcome in Education Today* (Berkeley, CA:

More general California history texts contain useful accounts of educational history as well. For instance, Kevin Starr, who has written extensively on California history, devotes part of his *Americans and the California Dream: 1850-1915* to a discussion of some of the religious denominations that entered California in its early years. He then examines the educational work that the various religious groups did in California. More generally, education for the period is considered.⁴⁷ *Rooted in Barbarous Soil: People, Culture, and Community in Gold Rush California*, edited by Kevin Starr and Richard Orsi, is another general California history book with focus on the Gold Rush era. In various chapters, information contextualizing education in California, especially with regard to religiously founded schools, is provided. The chapter by Irving Hendrick, “From Indifference to Imperative Duty: Educating Children in Early California,” particularly focuses on educational initiatives. He addresses state efforts starting with provisions in the state constitution and continuing with various legislative acts. Private, and more successful at least in terms of higher education, efforts are compared with the state ones.⁴⁸

Many additional texts consider specific individuals and colleges and universities in the

Sather Gate Book Shop, 1937). Some of his other books include Ferrier, *Berkeley, California: The Story of the Evolution of a Hamlet into a City of Culture and Commerce* (Berkeley, CA: The Author, 1933); Ferrier, *Henry Durant, First President, University of California; The New Englander who Came to California with College on the Brain* (Berkeley, CA: The Author, 1942); Ferrier, *Origin and Development of the University of California* (Berkeley, CA: Sather Gate Book Shop, 1930); and Ferrier, *Pioneer Church Beginnings and Educational Movements in California* (Berkeley, CA: The Author, 1927).

⁴⁷Kevin Starr, *Americans and the California Dream, 1850-1915* (New York: Oxford University Press, 1973).

⁴⁸Irving G. Hendrick, “From Indifference to Imperative Duty: Educating Children in Early California” in Kevin Starr and Richard J. Orsi, editors, *Rooted in Barbarous Soil: People, Culture, and Community in Gold Rush California* (Berkeley: University of California Press, 2000).

nineteenth century. Such biographies and institutional histories provide additional nuances to the study of the topic of higher education in the nineteenth century. They can also allow for a comparative examination of changes in education during the century.

Higher Education and Political Economy

Within higher educational institutions, the specific curriculum taught played an important role in how the schools functioned in society. Joel Spring contends that the role of a curriculum focused on Greek and Latin supported the goal traditionally of American colleges of making boys into gentlemen and preparing students for a profession. Spring notes that the Morrill Act of 1862 departed from these earlier aims and that during the nineteenth century, challenges arose from emphasizing reason and increased scientific interest. Although the Yale Report of 1828 emphasized the traditional classical curriculum and for the next few decades supported those educators who wanted to preserve this model, critics such as Henry Tappen, the University of Michigan's president from 1852 to 1863, argued for a broader type of college education, based in part on the German university system.⁴⁹ Tappen, for instance, "proposed the establishment of a scientific course of study that would parallel the classical curriculum. . . . [H]e stated, 'A farmer may find Chemistry very closely connected with his calling but what can he do with Latin and Greek and the higher mathematics.'" ⁵⁰ Tappen made this proposal in his 1852 inaugural address at the University of Michigan, one year after both Santa Clara College and the University of the

⁴⁹Joel Spring, "In Service to the State: The Political Context of Higher Education in the United States," in *The Academy in Crisis: The Political Economy of Higher Education*, John W. Sommer, ed. (New Brunswick, NJ: Transaction Publishers, 1995), 47-49.

⁵⁰Ibid., 49.

Pacific had been founded. As will be discussed, both were soon offering a scientific course of study that did not include Latin and Greek that the farmer (and future miner as the case might be in California) would have a difficult time utilizing. Whether any leaders of California's early colleges had knowledge of Tappen's address or how much knowledge they had of the German system is not known. However, they did move their colleges in a direction not unlike what Tappen had proposed.

Such responses to society's changing needs are addressed by Roger Meiners and Robert Staaf, who discuss the relationship of the political economy and education, including that of science education. They note that administrators react to changes in the political economy and to what education consumers want. Changing demands by consumers provide the "primary force" in eliciting a response from colleges and universities, although "some schools fail to respond to such pressures and decline."⁵¹ What can be surmised about the colleges in this dissertation is that they adjusted their curriculum in response to a demand by the consumers—parents and their children—so that they would not decline and disappear, although some did so more successfully than others.

Science in general has an important role in the economy's growth, and colleges and universities contribute to that role. These higher education institutions do that through their basic and applied research conducted by their professors as well as the students that graduate from the institutions. Even though the earliest California colleges were not research institutions as would be thought of in the twenty-first century, professors at these institutions engaged in scientific activities related to the Gold Rush, the electrification of California, and healthcare. On a broader

⁵¹Roger E. Meiners and Robert J. Staaf, "Property Rights in Academe," in Sommer, 201.

scale, Joseph Martino discusses science, technology, and economic growth and mentions how individuals in business, government, and academic science have all “identified science and technology as critical elements in the growth of the economy and in the production of goods and services.”⁵² Martino discusses several studies demonstrating the validity of this relationship and how the economy is benefitted by science and technology.⁵³ Such relationships occurred in California as the first colleges created linkages between them and the political economy of the state.

One example of such a linkage is the relationship between mining and education with the political economy. Education became more important to mining over the course of the second half of the nineteenth century. While many—if not most—of the first individuals to pan for gold throughout California would have had no education in mining, this began to change. Clark Spence describes the development of mining throughout the West and the role of mining engineers and that of education. He notes that not many years passed before formal training became a necessity, and miners who were not interested in an engineering career learned basic assaying, geology, and mineralogy. By the 1860s and 1870s, completing some technical training at an educational institution in the United States or abroad was seen as very desirable and even indispensable. While up until about 1870 European institutions provided the training for most mining engineers in the United States, after that time American schools became the primary source of education for them. However, even in the 1850s, early schools in California were offering classes in geology and mineralogy and may have had the necessary equipment for

⁵²Joseph P. Martino, “Science and Technology for Economic Ends,” in Sommer, 257.

⁵³*Ibid.*, 262.

assaying as well. Additionally, Spence comments that experienced miners looking back insisted that an engineer needed a good understanding of assaying, chemistry, geology, mathematics, and surveying as well as knowledge of languages and the law.⁵⁴ This illustrates how education from California colleges could provide the necessary skills that were needed in the political economy of the state.

Besides the specific examination of science's relationship to education, science had an important place in the general economic development of society in the nineteenth century.⁵⁵ A number of works address this topic. Norton Wise and Crosbie Smith provide an in-depth study of Lord Kelvin and his contributions to the political economy of Britain and beyond.⁵⁶ Their work includes developments in electricity, which will be seen to be important in the case of St. Ignatius College.⁵⁷ At St. Ignatius College's sister school, Santa Clara College, mining and consulting occupied non-teaching time for some professors. Paul Lucier's *Scientists & Swindlers*

⁵⁴Clark C. Spence, *Mining Engineers & the American West: The Lace-Boot Brigade, 1849-1933*, Yale Western Americana Series, 22 (New Haven, CT: Yale University Press, 1970), 24-25, 195.

⁵⁵For a discussion of how science, specifically geology, and political economy interacted in the early- to mid-nineteenth century, see Salim Rashid, "Political Economy and Geology in the Early Nineteenth Century: Similarities and Contrasts," *History of Political Economy* 13, no. 4 (1981): 726-744. Also dealing with the first half of the nineteenth century and looking at the economic and technological development of the United States is Daniel Walker Howe, *What Hath God Wrought: The Transformation of America, 1815-1848* (Oxford: Oxford University Press, 2007).

⁵⁶Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge University Press, 1989).

⁵⁷Another book dealing with electricity and electrification is Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore, MD: Johns Hopkins University Press, 1983).

examines the practice, with emphasis given to Benjamin Silliman and Benjamin Silliman Jr.⁵⁸ An account with a similar period as this dissertation but with a different geographic focus is *Nature's Metropolis* by William Cronon. Centered on the development of Chicago, the book relates industrialization and the economic development of Chicago.⁵⁹ A number of works look at the West and development more generally. Much of Western history has evolved in response to Frederick Jackson Turner's frontier thesis.⁶⁰ Several historians have responded to Turner's thesis and continued to move the field of Western history in new directions.⁶¹

Early California State Historiography

California history can be considered a subset of Western history in general, and many books have been written about the history of the state. Some of these have already been mentioned in connection with the historiography of higher education. As previously mentioned, Kevin Starr has written extensively on California history, and his books provide useful studies of

⁵⁸Paul Lucier, *Scientists & Swindlers: Consulting on Coal and Oil in America, 1820-1890* (Baltimore, MD: Johns Hopkins University Press, 2008).

⁵⁹William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton, 1991).

⁶⁰The frontier thesis was first presented in 1893 and can be found as the first chapter in Frederick Jackson Turner, *The Frontier in American History* (New York: H. Holt, 1921).

⁶¹Some of the works that have responded to Turner and provide new ways of looking at Western history include the following: Stephen Aron, *How the West Was Lost: The Transformation of Kentucky from Daniel Boone to Henry Clay* (Baltimore, MD: Johns Hopkins University Press, 1996); Patricia Nelson Limerick, *The Legacy of Conquest: The Unbroken Past of the American West* (New York: W. W. Norton, 1987); and Richard White, *"It's Your Misfortune and None of My Own": A History of the American West* (Norman: University of Oklahoma Press, 1991).

California from becoming a state to the present.⁶²

Other books, both monographs and edited volumes, give general overviews of California history.⁶³ A useful work is *A Companion to California History* edited by William Deverell and David Igler.⁶⁴ Essays included examine California from before statehood into the twenty-first century as the authors work to reconceptualize and complicate California's history. Of note for this dissertation is William Deverell's chapter, "The 1850s." In it, he argues that this decade "was of critical—even revolutionary—importance to California, and California to the nation" and that in general historians have not spent enough time on the nineteenth century as a whole but have moved on to the twentieth century even "when so many nineteenth-century questions continue to merit scholarly ideas and labors."⁶⁵ He also notes that during this period, the state "was at once very, very far away from and simultaneously intricately interwoven into the events,

⁶²Some of Kevin Starr's books on California history include the following: Kevin Starr, *California: A History* (New York: Modern Library, 2007); Starr, *Americans and the California Dream, 1850-1915* (New York: Oxford University Press, 1986); Starr, *Continental Ambitions: Roman Catholics in North America: The Colonial Experience* (San Francisco: Ignatius Press, 2016); Starr, *Inventing the Dream* (New York: Oxford University Press, 1985); and a number of others that span the twentieth century. He also contributed to books including one in which he was an editor: Kevin Starr and Richard J. Orsi, editors, *Rooted in Barbarous Soil: People, Culture, and Community in Gold Rush California* (Berkeley: University of California Press, 2000).

⁶³For instance, one work that describes the writing of California's state constitution and the circumstances leading up to that as well as what happened following its adoption is David Alan Johnson, *Founding the Far West: California, Oregon, and Nevada, 1840-1890* (Los Angeles: University of California Press, 1992). As the title indicates, he does a similar study of Oregon and Nevada.

⁶⁴William Deverell and David Igler, editors, *A Companion to California History* (Chichester, UK: Blackwell Publishing, 2008).

⁶⁵William Deverell, "The 1850s," in Deverell and Igler, 162 (italics in original).

lives, and disagreements of Americans to the east.”⁶⁶ The higher education institutions that will be discussed by being far away from the eastern United States had to adapt to local conditions while still being affected by events such as the Civil War and the Morrill Act and the way education was conducted elsewhere in the country.

Of the many works that focus on the Gold Rush, a few stand out.⁶⁷ While some look more specifically at the Gold Rush itself, others examine its legacy.⁶⁸ Various books address the Civil War as well as racial and ethnic relations in California.⁶⁹ Finally, some other works deal more

⁶⁶Ibid., 163.

⁶⁷Some of the more prominent works on the Gold Rush include the following: Rodman W. Paul, revised and expanded by Elliot West, *Mining Frontiers of the Far West, 1848-1880* (Albuquerque: University of New Mexico Press, 2001); S. Holliday, *The World Rushed In: The California Gold Rush Experience* (New York: Simon & Schuster, 1981); Malcolm J. Rohrbough, *Days of Gold: The California Gold Rush and the American Nation* (Berkeley: University of California Press, 1997); Brian Roberts, *American Alchemy: The California Gold Rush and Middle-Class Culture* (Chapel Hill: University of North Carolina Press, 2000); and James J. Rawls and Richard J. Orsi, eds., *A Golden State: Mining and Economic Development in Gold Rush California* (Berkeley: University of California Press, 1999).

⁶⁸These books include the following: David Vaught, *After the Gold Rush: Tarnished Dreams in the Sacramento Valley* (Baltimore, MD: Johns Hopkins University Press, 2007); Peter R. Decker, *Fortunes and Failures: White-Collar Mobility in Nineteenth Century San Francisco* (Cambridge, MA: Harvard University Press, 1978); Steven Soll, *The Fruits of Natural Advantage: Making Industrial Countryside in California* (Berkeley: University of California Press, 1998); and Andrew C. Isenberg, *Mining California: An Ecological History* (New York: Hill and Wang, 2005).

⁶⁹Books that deal with these topics include the following: David Potter, *The Impending Crisis, 1848-1861* (New York: Harper & Row, 1976); Leonard L. Richards, *The California Gold Rush and the Coming of the Civil War* (New York: Alfred A. Knopf, 2007); Alexander Saxton, *The Indispensable Enemy: Labor and the Anti-Chinese Movement in California* (Berkeley: University of California Press, 1971); Albert L. Hurtado, *Indian Survival on the California Frontier* (New Haven, CT: Yale University Press, 1988); and David Wyatt, *Five Fires: Race, Catastrophe, and the Shaping of California* (Reading, MA: Addison-Wesley Publishing Company, 1997).

specifically with California's political economy.⁷⁰

The colleges that I will be examining in the dissertation were not independent of their environment but operated in the world that is discussed by the historians above. The higher education and the California history sources provide a basis for understanding the political economy that these educational institutions interacted with and contributed to. Through studying this historiography I have been able to better fit the narrative of the dissertation into the larger story of California and educational history.

⁷⁰Karen Clay, by herself and with others, has several useful works including the following: Karen Clay, "Trade Without Law: Private-Order Institutions in Mexican California," *Journal of Law, Economics, and Organization* 13, no. 1 (April 1997): 202-31; Clay, "Trade, Institutions, and Credit: Contract Enforcement on the California Coast, 1830-1846," *Explorations in Economic History* 34, no. 4 (October 1997): 495-521; Clay, "Property Rights and Institutions: Congress and the California Land Act of 1851," *Journal of Economic History* 59, no. 1 (March 1999): 122-42; Karen Clay and Werner Troesken, "Ranchos and the Politics of Land Claims," in *Land of Sunshine: Toward an Environmental History of Los Angeles*, edited by William Deverell and Greg Hise (Pittsburgh, PA: University of Pittsburgh Press, 2005); Clay and Troesken, "Squatting and the Settlement of the United States: New Evidence from Post-Gold Rush California," *Advances in Agricultural Economic History* 1 (2000): 207-33; Karen Clay and Gavin Wright, "Order Without Law? Property Rights During the California Gold Rush," *Explorations in Economic History* 42, no. 2 (April 2005): 155-183; and Clay and Wright, "Gold Rush Legacy: American Minerals and the Knowledge Economy," prepared for "The Evolution of Property Rights Related to Land and Natural Resources" conference, September 2010, revised February 2011. Richard A. Walker has a number of works on California as a whole and San Francisco in particular. These include the following: Richard A. Walker, "Industry Builds the City: Industrial Decentralization in the San Francisco Bay Area, 1850-1940," *Journal of Historical Geography* 27, no. 1 (2001): 36-57; Walker, "California's Golden Road to Riches: Natural Resources and Regional Capitalism, 1848-1940," *Annals of the Association of American Geographers* 91, no. 1 (2001): 167-99; and Walker, *The Conquest of Bread: 150 Years of California Agribusiness* (New York: New Press, 2004). For an examination of politics and finance in California from 1850 to 1930, see Thomas Michael Laichas, "'Robbing Peter to Pay Paul': Public Finance and Political Change in California, 1850-1930" (PhD diss., University of California, Los Angeles, 1999).

Political Economy of California

Like the United States in general, California experienced industrialization, rapid development, and population growth certainly from the start of the Gold Rush. However, California's political economy and general development can be traced back much further to at least when the Spanish entered the region. Richard Walker notes that California had been part of the global economy from the 1770s when the Spanish came into Alta California but that it was the Gold Rush that put California in the "global spotlight."⁷¹ Likewise, James Quay posits that the Gold Rush "was a defining moment for California, one that turned a sleepy province on the far edge of the continent into a true El Dorado."⁷² Gerald Nash argues that the Gold Rush contributed to many sources of economic development in California and the nation and can, thus, be seen as a "multiplier," which economists would define as "an event that accelerated a chain of interrelated consequences, all of which accelerated economic growth."⁷³ This can be seen through the growth of California's population and development of its financial and other resources.

In terms of California's population, before the Gold Rush and statehood, the 1847 non-indigenous population was about 13,000. Two years later, 80,000 men arrived that year and by 1854 the new state had a population of around 300,000.⁷⁴ By 1880, the state's population had

⁷¹Richard A. Walker, "At the Crossroads: Defining California through the Global Economy," in Deverell and Iglar, 77.

⁷²James Quay, "Beyond Dreams and Disappointments: Defining California through Culture," in Deverell and Iglar, 6.

⁷³Gerald Nash, "A Veritable Revolution: The Global Significance of the California Gold Rush," in Rawls and Orsi, 276.

⁷⁴Quay, 6.

grown to one million, an eightfold increase in thirty years.⁷⁵ Similarly, San Francisco went from a small town of 800 in 1847 to one of the ten largest cities in the United States by 1870 with a population of 150,000.⁷⁶ Ten years later, the city was home to about a quarter of the state's residents with a population of 233,000.⁷⁷ Also due to the Gold Rush, California was a destination for emigrants from not only the United States but around the world, including Europe, Asia, and Latin America. Nearly forty percent of the state's population was foreign born in 1860 and by 1890 that number was still about thirty percent.⁷⁸

The influx of migrants due to the Gold Rush was accompanied by an outflow of gold and other minerals from the mining regions. In just six years between 1849 and 1855, gold worth at least \$400 million had been extracted.⁷⁹ Over the course of the first twenty years from statehood, extracted California gold totaled approximately \$1 billion. The Nevada silver rush and silver mining in California also contributed to the growth of San Francisco and its businesses. Mercury also became a major California export, and from 1850-1880 California's quicksilver output was more than half of the world's total.⁸⁰ Industrialization came to this industry as new technology replaced placer mining that the solo miners had used. Mining, however, was not California's only economic driver. As mining slowed, agriculture played a more prominent role in the California

⁷⁵Johnson, 238.

⁷⁶Quay, 6; Walker, 78.

⁷⁷Johnson, 238.

⁷⁸Isenberg, 13.

⁷⁹D. J. Waldie, "Rereading, Misreading, and Redeeming the Golden State: Defining California through History," in Deverell and Iglar, 26.

⁸⁰Walker, 77.

economy, and industrialization also played a role in agriculture.⁸¹ Beginning in the 1860s, wheat became an ever more important export until by the 1870s and 1880s, wheat accounted for two-thirds of California's non-mineral exports. This led agriculture in general to become the most important part of California's economy by the 1880s. Manufacturing also grew with San Francisco becoming the most important California city for this. In fact, by 1870 more manufactured goods came out of San Francisco than all other western cities combined.⁸²

All of this economic activity led to creating thousands of new businesses, including financial, manufacturing, and service. Demand increased for more transportation, and the amount of commerce and trade heightened. This included everything from steamboats to hardware and mining supplies as well as staples like food and clothing.⁸³ Educational institutions also had an increase in demand and were created as well.

Background of Higher Education in California

While it was not until a year after statehood that the first higher education institutions were founded in California, in the years preceding statehood grade schools had been established. As will be discussed in subsequent chapters, education was discussed at the California Constitutional Convention of 1849 and an article on education was included in the state constitution. This article dealt with common schools, education funding, and the establishment of a state university.

⁸¹Douglas Cazaux Sackman, "Nature and Conquest: After the Deluge of '49," in Deverell and Iglar, 181, 184.

⁸²Walker, 78.

⁸³Nash, 276-277.

The year California became a state, the 1850 census reported that the United States had “119 colleges, along with 44 theological seminaries, 36 medical schools, and 16 law schools. And by 1876 the United States Bureau of Education could report 356 colleges and universities, 124 theological seminaries, 78 medical schools, and 42 law schools.”⁸⁴ During those twenty-six years when the number of colleges in the nation more than doubled, California contributed to that rise with several new colleges of its own. Irving Hendrick argues that it was during this period that Californians “created the initial and fledgling educational institutional structures that would serve them and succeeding generations for the balance of the nineteenth century and through the entire twentieth century.”⁸⁵ As Californians created the initial educational institutional structures, the political economy came into play as Hendrick notes that “education in gold-rush California was the product of what went before and what was occurring at the time. The achievements were notable.”⁸⁶ These achievements included founding two higher education institutions just one year after statehood. Although early institutions may have struggled at times, as they worked within the political economy they found ways to adapt and provide structures for higher education in the state.

Another impetus for founding institutions of higher education in California was a desire to allow California’s young people to be educated at home, instead of going to the East Coast or traveling to Europe, and thus the graduates could then more readily contribute back to the California political economy. One such individual who advocated this was John Doyle, a lawyer

⁸⁴Cremin, *The National Experience*, 400. Cremin notes that in 1831 there were forty-six colleges in the United States.

⁸⁵Hendrick, 247.

⁸⁶Ibid.

who spoke at the opening of a new building at Santa Clara College in 1870. In his address, he presented arguments concerning the benefits of education in California. Acknowledging some obvious reasons for education close to the individuals' homes, Doyle stated that a California education could help fix a societal problem, namely that California society was "*not sufficiently Californian*. Our community has not yet entirely thrown off the character of a colony . . . [and this idea is] one fatal to the prosperity of the state."⁸⁷ His solution was "to educate our youth at home. Let us build up and encourage institutions of learning, here, at our own doors. If those we have are in any degree inferior to similar ones abroad, let our effort be to raise them to the highest standard."⁸⁸ Convinced that the California colleges would be able to match an education elsewhere, he believed that a California education would prepare those students "for Californian citizenship—the duties and responsibilities of which they are to assume. Let us teach them to appreciate and feel a just pride in their own State, and even their own county and neighborhood, and in the institutions at which they themselves have been reared, and in the prosperity and development of which they must ever thereafter feel the liveliest interest."⁸⁹ This call for education within the state presented succinct arguments as to why parents should opt to send their children to the several California higher education institutions that by this time included Santa Clara College, the University of the Pacific, St. Ignatius College, the University of California, and the California State Normal School among a few others.

⁸⁷John T. Doyle, *Address Delivered by John T. Doyle, Esq. at the Inauguration of the New Hall of Santa Clara College, on Tuesday, August 9th, 1870* (San Francisco: Edward Bosqui & Co., Printers, 1870), 16, The Bancroft Library, University of California, Berkeley (italics in original).

⁸⁸*Ibid.*, 17.

⁸⁹*Ibid.*, 18.

Religious Colleges in California

The earliest colleges in California were religiously affiliated, and thus it is important to consider the religious nature of the higher education institutions. As Mark Noll points out, studying higher education institutions with religious affiliations can provide a fruitful basis for further research. He notes that among the areas that can be studied include ethnic history, intellectual history, ecclesiastical history, social history, and political history.⁹⁰ What Noll does not include in his list is how history of science can also be examined through such institutions; those schools in my dissertation will touch upon many of the areas Noll mentions while highlighting the role of science.

Throughout much of American history, religious groups founded most higher educational institutions. Although the content of a mathematics class would be similar from one religiously-affiliated school to the next, other aspects—such as codes of conduct and philosophy of education—could be more directly related to the various religious groups. In California, particular theological beliefs would not determine whether a metallurgy class, for instance, would be taught. Nonetheless, differing religious traditions should be noted for what they can say about their respective institutions.

As already noted, the earliest colleges in California were founded by Protestant denominations or Catholic orders. These included the Jesuits, Methodists, Congregationalists, and Presbyterians. Others, such as the Christian Brothers, Quakers, and Seventh-day Adventists,

⁹⁰Mark A. Noll, Introduction to Ringenber, 2. His rationale for each of the historical fields is as follows: ethnic history due to sponsoring groups' ethnic heritages; intellectual history because of the ideas discussed at the institutions; ecclesiastical history as the colleges have often played important roles in various denominations' histories; social history because of the connections with economics, family, professionalization, and vocation; and political history as the colleges interact with various political groups and preferences.

also founded schools in California's first few decades. Each of these groups brought their own perspectives and educational motivations. Religious leaders and funding sources elsewhere in the country or the world may have been the impetus for originally founding educational institutions in California, and these leaders and funders also could set the basic perimeters for what kind of institution would be developed. However, as will be subsequently demonstrated, once the schools were established in California, local leaders worked to make the schools meet the needs there. This sometimes brought them into conflict with their superiors outside of California. While the actual science that was taught and conducted at the schools was not, at least in this period, dependent upon theological beliefs, how science was emphasized or the degree to which the professors and schools may have been prepared with the latest in scientific and technological advancements may have been affected at least to some extent by the educational traditions of the various religious groups.

Additionally, the denominational colleges, especially in the West, were a key institution and ones that played a significant role in the local political economy. While it is true that Catholics and Protestants took pride in their colleges and would sometimes look derisively at other colleges, both Protestant and Catholic colleges had similar aims, especially by the middle of the nineteenth century. The primary motive of both became an emphasis on providing society with educated lay individuals as opposed to an educated clergy.⁹¹

Protestants and Catholics also worked to found colleges in California as they competed with each other for members and endeavored to become an integral part of California life. As California's population grew, religious groups from elsewhere in the nation and the world rushed

⁹¹Geiger, *The American College in the Nineteenth Century*, 5, 21, 115, 138.

to send in people and money to support their religious work in the state, and this work often included the establishment of schools. González Rubio, the interim administrator of the Catholic diocese of California, noted that both Catholics and Protestants had no one that they could trust to educate their children.⁹² This need for schools played into the religious competition—among various denominations and between Protestants and Catholics in general—that was occurring in the western United States.

Prominent New England minister Lyman Beecher described the western frontier as the location where Protestantism moving westward from the eastern states and Roman Catholicism moving northward from Latin America competed with each other. Beecher contended that one of these religious groups must eventually win.⁹³ With this mindset, missionaries from the Atlantic states came to California, often funded by Protestant evangelical mission societies.⁹⁴ Likewise, Catholics did all they could to make California into as much of a Catholic stronghold as possible. This included the establishment of the Franciscan mission system, San Francisco becoming an archdiocese very quickly, and educational work by Dominican sisters and Jesuits in the San Francisco Bay Area.⁹⁵

The efforts by Protestants and Catholics in the years following the discovery of gold was

⁹²Gerald McKeivitt, *The University of Santa Clara: A History, 1851-1977* (Stanford, CA: Stanford University Press, 1979), 11-13.

⁹³Kevin Starr, “Rooted in Barbarous Soil: An Introduction to Gold Rush Society and Culture,” in Starr and Orsi, 15.

⁹⁴Steven M. Avella, “Phelan’s Cemetery: Religion in the Urbanizing West, 1850-1869, in Los Angeles, San Francisco, and Sacramento,” in Starr and Orsi, 254.

⁹⁵Starr, “Rooted in Barbarous Soil,” 15. In the San Francisco Bay Area, the first Catholic outreach came with the founding of Mission Dolores in San Francisco in 1776. Avella, 263.

directed at the inhabitants of the region, many of whom were miners. Those from New England and the South were generally Protestant while miners originally from Ireland, France, Peru, Chile, and Mexico in addition to many of the Californios and Native Americans were most likely Catholic.⁹⁶ As new towns and cities were created, their growth was in part due to the various religious establishments, such as educational institutions, that were founded in Gold Rush California. Such institutions had an effect on the surrounding community, and the line between the secular and the sacred was often blurred; religious groups invested in the local political economy through the buying of land and the construction of buildings for churches, hospitals, and schools. Out of this involvement came a greater social peace and sometimes interactions with local politics.⁹⁷ In the cities and towns of Northern California especially, religious groups acted as “agents of urbanization.”⁹⁸ These groups did everything from providing social welfare to constructing churches, colleges, and schools, and thus raising property values. They also enhanced the intellectual and moral tenor of society.⁹⁹ The colleges and schools that were founded contributed to the political economy independent of their religious affiliation but certainly having the backing of a religious organization helped them to survive.

These educational institutions, and specifically the colleges, were not only a part of the political economy but also a key element in the competition between religious groups. Protestants fought against what they perceived as “the twin evils of infidelity and Roman Catholicism. The

⁹⁶Starr, “Rooted in Barbarous Soil,” 15.

⁹⁷Avella, 254.

⁹⁸Ibid., 260.

⁹⁹Ibid.

West had to be won for the churches; it also had to be saved from the threat posed by a floodtide of foreign emigration from Catholic Europe.”¹⁰⁰ Coupled with the influx of Protestant settlers from the East, Catholics worried about Protestant successes in “Catholic” California, which added to the motivation to found colleges.¹⁰¹ With the successful launching of Catholic colleges in California and elsewhere in the West, Protestant fears intensified. One pamphleteer wrote in 1856 that these concerns were excited by “ ‘the calm, shrewd, steady, systematic movement of the Jesuit order . . . in California . . . there our great battle with the Jesuit, on Western soil, is to be waged. We must build college against college.’ ”¹⁰² This undoubtedly spurred on the building of Protestant colleges. While the initial motivations for the founding of religiously-sponsored schools may have been mixed and complicated, what resulted, including through their science education, was important interactions with the political economy.

Conclusion

With statehood and the founding of the first California colleges, higher education in California had begun. Though at first relatively small in size, these schools expanded and many new schools joined their ranks. As individuals flowed into the new state, many of them lured by the prospect of easy riches in the gold fields, infrastructure and institutions were needed to keep up with the burgeoning population. Industrialization, mining, and agriculture picked up steam in California and drove the political economy of the state.

¹⁰⁰McKevitt, 2.

¹⁰¹Ibid.

¹⁰²E. N. Kirk, *Discourse Before the S.P.C.T.E.W.* (pamphlet, 1856), quoted in Ibid.

Although the earliest colleges were all religious in nature, their role in society was less about their religious roots and more about the educational opportunities they offered. Among those educational opportunities were the teaching and practice of science. Science, in a variety of forms, had been capturing the imagination of American society to an ever greater degree. Educational institutions, through their classes, students, and professors, would play an important role in the development of science and technology. Educators like Tappan, Wayland, and Eliot and thinkers like Spencer called for changes in curriculum. As these institutions continued to change, science education played an important role in defining these schools and contributing to the political economy. The ways in which California's political economy and science education in the state's earliest colleges interacted with each other is the subject of this dissertation.

Chapter 2

Jesuit Education in California: Santa Clara College and St. Ignatius College

Introduction

The California Gold Rush brought settlers to the West Coast of North America by whatever means possible. In this time before the transcontinental railroad, immigrants to what would become the “Golden State” traveled by ship and covered wagon to seek untold riches. While these riches did not materialize for many, a population surge nonetheless occurred, leading to California statehood in 1850. As the political economy developed, mining became less important over time with the development of new infrastructure and institutions.

Colleges were among the new institutions created in the first years of California statehood. Long after grade schools had been established and following discussion of education at the 1849 California Constitutional Convention, higher education began in California. Prior to this, grade schools had been present periodically during Mexican rule, and in December 1846 the “First American School” (as it was the first grade school founded after American occupation of California) opened on the grounds of the Santa Clara Mission.¹ While California’s first state constitution included a section on higher education and the establishment of a state university, it took nearly two decades after California became a state for the University of California to be established. In the meantime though, various religious groups founded institutions of higher education. Of these institutions, Santa Clara College was one of the first.

¹William Warren Ferrier, *Ninety Years of Education in California, 1846-1936: A Presentation of Educational Movements and their Outcome in Education Today* (Berkeley, CA: Sather Gate Book Shop, 1937), 26-27, 13.

Santa Clara College and its sibling college, St. Ignatius College, were both Jesuit institutions. Santa Clara College, now Santa Clara University, was founded in 1851 in Santa Clara, south of San Francisco (the same year and the same town as the Methodist's University of the Pacific). Four years later in San Francisco, St. Ignatius College, now the University of San Francisco, was begun. Both institutions had only male students throughout the nineteenth century. As this chapter argues, these two Jesuit Catholic schools both would play an important role in the political economy of California. Science and technology were significant aspects in the work of their professors and the teaching that they did. Additionally, science and technology were crucial in California's development in its first few decades. With the California Gold Rush, and mining in general, driving the early years of the state's economy, classes related to mining and metallurgy as well as instruction in assaying and surveying became useful in the education of individuals who would help the state to grow. As California continued to develop, agriculture became more important to the political economy.

Santa Clara College and St. Ignatius College interacted with California's political economy in areas of science and technology. Their curriculum and professors provided instruction, knowledge, materials, and expertise that aided in the continued development of these areas. Professors taught courses related to metallurgy and assaying, and colleges' scientific equipment allowed for experiments and instruction in other areas of science and technology. Faculty also wrote articles on agriculture and contributed to the electrification of San Francisco.

The Jesuits' long tradition of scientific curiosity coupled with their educational system prepared those Jesuits in California with a background that enabled them—and the schools they worked at—to contribute to the state. It was this background, rather than specific Jesuit theological beliefs, that drove their interactions with the political economy and scientific

contributions. The Jesuit order, along with other Catholic orders and Protestant denominations, was crucial in founding schools of all levels in California and across the United States. Intentions of converting souls for God or preventing other religious groups from taking away their members may have helped spur religious groups to go to California in the footsteps of the miners. However, once they arrived many of these same religious individuals fostered a growing society in California. This educational work aided in the development of the state's economy, and, notwithstanding the previously mentioned motivations for journeying to California, theological concerns did not change the general course of instruction. While religious instruction and devotion were part of the life of such schools, religious schools welcomed students from various religious backgrounds and offered a curriculum that included what would benefit the local economy. Along with religious services came the teaching of theoretical physics and other knowledge that could help explain the mysteries of God's creation. Crucially, such theoretical subjects were complementary to the applied science and technology that was also being taught. Thus, Santa Clara College and St. Ignatius College had a science education that interacted with the political economy of California.

The Society of Jesus, Education, and Science

By the time Santa Clara College opened its doors in 1851, the Society of Jesus, or Jesuits, had a long tradition of education, including one that dealt with faith and science. This tradition would play out in California with Santa Clara College and St. Ignatius College. Ignatius of Loyola, the founder of the Jesuits, had early on made education a key part of the order's duties. Jesuits had begun teaching theology in Rome as early as 1537, even before Pope Paul III's official recognition of the order in 1540. Another Jesuit became a professor at Ingolstadt in

Bavaria in 1543. The creation of a formal educational plan went beyond the original educational conception of preaching and teaching the catechism. Ignatius concluded that the Society of Jesus would be able to provide service to the Catholic Church through education, and in 1551, he proposed the founding of colleges throughout Europe by the order.²

With Ignatius' recommendation that the Society of Jesus enter education, documents were developed to guide in the administration of schools. These included the fourth part of the *Constitutions*, which Ignatius finalized in 1551, the *Ratio Studiorum* or *Plan of Studies*, which was completed in 1599.³ These two documents attempted to bring together aspects of the humanistic and scholastic traditions in an effort to make the Jesuit schools successful. Scripture received primacy over other subjects in the *Ratio Studiorum*.⁴ The *Ratio* dealt with external matters—branches of study, organization, administration, and, from 1599 to 1773, it provided the basis for the Jesuit educational system.⁵ It was revised in 1832, and the pedagogical system laid out in the *Ratio* placed a high emphasis on the early moral and mental formation of students. A typical Jesuit college, then, included a department similar to a modern high school for instructing younger boys, while a second department was at a college level. Boys would enter the school

²William V. Bangert, *A History of the Society of Jesus* (St. Louis, MO: The Institute of Jesuit Sources, 1972), 22-24, 26-27. Ignatius died in 1556. See *Ibid.*, 45.

³*Ibid.*, 27-28, 43. The *Constitutions* promulgated the general principles that the Society of Jesus was to accomplish its goals and was divided into ten parts. See John W. O'Malley, *The First Jesuits* (Cambridge, MA: Harvard University Press, 1993), 7.

⁴John W. O'Malley, "The Jesuit Educational Enterprise in Historical Perspective," in *Jesuit Higher Education: Essays on an American Tradition of Excellence*, ed. Rolando E. Bonachea (Pittsburgh, PA: Duquesne University Press, 1989), 16, 19.

⁵George E. Ganss, "St. Ignatius and Jesuit Higher Education," in Bonachea, 154.

around twelve years of age and graduate seven to eight years later.⁶

Ignatius argued that the goal of education should be forming cultured, Catholic men, who could actively and intelligently participate in all aspects of society, including religious, cultural, and civil life, and stated this in the fourth part of the *Constitutions*.⁷ The Jesuits instituted pedagogical reforms as they sought to create citizens that had Christian morals and civic values.⁸ The educational section of the *Constitutions*, with the articulation of Ignatius's worldview, provided guiding principles for Jesuit schools—in terms of their curriculum, structures, and activities—from the mid-sixteenth century to the present.⁹

The Jesuit educational system succeeded, at least partly, because the educational program utilized the best elements of various educational traditions. This included drawing from the Italian Humanists in studying classical texts to develop citizens that were literate, cultured, and socially responsible. Another tradition Jesuits used as a model was a spiritual education program. The Jesuits' educational system also utilized the Parisian scholastic educational tradition, which included having a class system that was graded, a daily schedule strict in nature, and the use of compositions, disputations, and reputations as exercises for learning. Additionally, the curriculum in Jesuit schools found a basis in the Humanists for the teaching of languages,

⁶Gerald McKeivitt, *Brokers of Culture: Italian Jesuits in the American West, 1848-1919* (Stanford, CA: Stanford University Press, 2007), 211.

⁷Bangert, 43.

⁸Alison Simmons, "Jesuit Aristotelian Education: The *De anima* Commentaries," in *The Jesuits: Cultures, Sciences, and the Arts, 1540-1773*, ed. John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy (Toronto: University of Toronto Press, 1999), 522.

⁹Ganss, 154, 156.

literature, and rhetoric, while arts, philosophy, and theology drew upon Aristotelian philosophy and Thomistic theology.¹⁰

The use of these educational traditions alone would not have been enough for Jesuit schools to be successful. Instead, several factors contributed to both the initial and long-term success of these institutions. Some of these characteristics were still present at the time of the founding of Santa Clara and St. Ignatius Colleges. One such characteristic was the international network of schools that could help facilitate the transfer of both knowledge and professors. Another characteristic was the acceptance, at least in principle, of students from any social class. However, other common factors were not present in the Jesuit schools in California. For instance, traditionally Jesuit schools did not charge tuition.¹¹ While this had worked well generally since the 1500s, the circumstances present in California in 1851 prompted the founders of Santa Clara College to charge tuition to support the operation of the college.¹² While in Europe Jesuits had relied on nobility to fund their schools, this model did not work in the United States. Thus, as early as 1831 the head of the Society of Jesus gave permission for schools in America to charge tuition.¹³

With this foundation for Jesuit educational institutions, Jesuit colleges would eventually

¹⁰Simmons, 522.

¹¹O'Malley, *The First Jesuits*, 226. Ibid., 226-227 lists a total of ten characteristics that the author argues contributed to the success of the Jesuit schools.

¹²Gerald McKevitt, *The University of Santa Clara: A History, 1851-1977* (Stanford, CA: Stanford University Press, 1979), 57.

¹³Father General Jan Roothaan to Cal. Provincial, July 6, 1831, Correspondence to/from Jesuit Fathers General, Rome, and California Mission Superiors and Provincials, Box 1, California Jesuit Archives, Santa Clara, CA. Summarized from Latin by Dan Peterson, archivist, California Jesuit Archives.

take hold throughout the United States. By the time of the suppression of the Jesuits in 1773, more than eight hundred Jesuit educational institutions had been established throughout the world.¹⁴ Although during the suppression no Jesuit schools were founded, when the first Catholic school in the United States was founded in 1789, Jesuits (or ex-Jesuits) were involved. This school, Georgetown College (now Georgetown University), was founded by John Carroll, a former member of the Society of Jesus and the first bishop of Baltimore, and he employed ex-Jesuits to run the school. Georgetown became the first of the American Catholic colleges and universities, of which many would be run by the Jesuits. Following the restoration of the Jesuit order in 1814 and as Jesuits left Europe to escape persecution, the Society of Jesus began opening more schools across the country.¹⁵ As they did, and as will be demonstrated in this chapter, the schools in the United States were modified to meet the local needs, while maintaining the relevant Jesuit educational traditions. Among the schools opened in the United States were one of the first two schools in California, Santa Clara College in 1851, and another school, St. Ignatius College in 1855.

The Jesuit colleges that sprung up in Europe and North America had many different and sometimes conflicting meanings and attributes. Some of these representations included the colleges being portrayed not simply as a place for pedagogy but also as a place for discussion of theological and philosophical matters, a center for astronomical viewing, a repository of natural and artificial exhibits, a laboratory for alchemy, and a place to bring together news and

¹⁴O'Malley, *The First Jesuits*, 239. See also R. Po-Chia Hsia, *The World of Catholic Renewal, 1540-1770* (Cambridge: Cambridge University Press, 1998), 32-33.

¹⁵Bagert, 407, 479-493.

information from Jesuit missionaries throughout the world.¹⁶ Therefore, Jesuit colleges were not only defined by their strictly educational activities but also their scientific ones, including conducting research in astronomy, alchemy, and various other scientific fields.¹⁷

The Society of Jesus had an equally long tradition of mathematical and scientific activity alongside education.¹⁸ From nearly the time of their founding, Jesuits were often involved in scientific controversies, discoveries, and the writing of textbooks.¹⁹ By the mid-seventeenth century, Jesuits were publishing scientific texts for classroom use, including works on astronomy, botany, geology, paleontology, and physics.²⁰ Jesuits taught and wrote on these mathematical and scientific fields, conducted observations and laboratory experiments, and received recognition in these areas.²¹ This would be true in California as well.

¹⁶Michael John Gorman, “From ‘The Eyes of All’ to ‘Useful Quarries in philosophy and good literature’: Consuming Jesuit Science, 1600-1665,” in O’Malley et al., 171.

¹⁷For an analysis of Jesuit science, including from a quantitative perspective, see Steven Harris, “Jesuit Ideology & Jesuit Science: Scientific Activity in the Society of Jesus 1540-1773” (PhD diss., University of Wisconsin-Madison, 1988). Harris’s chapter on “The Apostolates,” especially, details the linkages between science and Jesuit educational institutions in the seventeenth and eighteenth centuries.

¹⁸For instance, see Amir Alexander, *Infinitesimal: How a Dangerous Mathematical Theory Shaped the Modern World* (New York: Farrar, Strauss, and Giroux, 2014), which in part discusses the Jesuits and how mathematics became a high priority for the order.

¹⁹Other works that deal with the Jesuits and science include the following by J. L. Heilbron: J. L. Heilbron, *Electricity in the 17th and 18th Centuries: A Study of Early Modern Physics* (Berkeley: University of California Press); Heilbron, *Elements of Early Modern Physics* (Berkeley: University of California Press, 1982); and Heilbron, *The Sun in the Church: Cathedrals as Solar Observatories* (Cambridge, MA: Harvard University Press, 1999).

²⁰Bagert, 180.

²¹O’Malley, *The First Jesuits*, 241-242.

Founding of Santa Clara University

Roman Catholicism had long been a part of California society going back to the Spanish days and the establishment of the missions throughout the region. In January 1777, a Franciscan priest with a band of Spanish soldiers arrived at what became Santa Clara. They established Mission Santa Clara as the eighth in the chain of California missions. Mission Santa Clara became the center of Hispanic life in this region of California, and at its height was the home to nearly fifteen hundred Native Americans, soldiers, and friars. However, by 1836 (three years after the Mexican legislature decreed the dissolution of the mission system in California), Mission Santa Clara became only a parish church with just a few Mexican priests to take care of it.²²

The opening of California to the Jesuits and the subsequent founding of Jesuit colleges at Santa Clara and San Francisco was due in large part to the energetic campaign of Italian Jesuit priest Michael Accolti, who became the superior of Jesuit activities along the Pacific Coast. Even though California was not initially in his jurisdiction, Catholics in San Francisco, Sacramento, San Jose, and Sonora all suggested that he build a school in their community. Another Jesuit, John Nobili, was a traveling companion and fellow missionary of Accolti. Both visited California, and Nobili remained there. The Dominican bishop of California, Joseph Sadoc Alemany, who was concerned about the educational conditions in California, offered the Jesuits the Franciscan mission of Santa Clara, which Nobili accepted to establish a Jesuit school.²³ Thus with the support of Accolti, on March 19, 1851, Nobili opened Santa Clara College in a mission

²²McKevitt, *The University of Santa Clara*, 8-9.

²³*Ibid.*, 14-29.

building at Santa Clara (which had also been the site of the first American grade school).²⁴ Soon after that in May 1851, Nobili admitted the first pupils and thus became the first institution of higher education to begin instruction in California.²⁵ This development was heralded by the San Francisco-based newspaper, the *Daily Alta*. It stated that having a “moral and literary institution” was “much needed in that part of country.”²⁶ While neither Santa Clara College nor the other first higher education institutions in California were truly colleges at the start, collegiate classes were soon offered. Elementary education in 1851 led to secondary classes in 1852 and the first college classes during the 1853-54 school year, leading to the awarding of California’s first bachelor’s degree in 1857.²⁷

In the early years, Nobili faced difficulties, most notably due to a lack of well-trained faculty, which never exceeded ten. In spite of the best efforts of Nobili and Accolti, no help was forthcoming from the Jesuit superiors in Rome. This prompted Accolti to appeal in person to the Jesuit leadership in Italy in 1853. Accolti’s trip proved a success when the Jesuits of the Province of Turin, Italy, adopted California as their permanent mission site. With this new support, the number of university-trained faculty was assured, and by 1855 Santa Clara College had a faculty numbering eighteen, almost doubling the previous number of faculty. This development along with the securing of a \$20,000 endowment required by the state provided Nobili with the

²⁴Ferrier, 199.

²⁵While Santa Clara College was the first institution to begin instruction, the University of the Pacific was the first institution of higher education to be incorporated. McKevitt, *The University of Santa Clara*, 27.

²⁶“School in Santa Clara,” *Daily Alta* (San Francisco), May 16, 1851, 2.

²⁷McKevitt, *The University of Santa Clara*, 27-28.

necessary confidence to apply for a state charter for the school.²⁸ By this time, the school had a board of twelve trustees and ninety students as well as a library of 10,000 books and a chemical apparatus.²⁹

Following this, the first prospectus for Santa Clara College was published. It stated that the “College has been incorporated (on the 28th of April, 1855,) under an act passed by the last legislature, and is now empowered to confer degrees and academical honors, and to exercise all the rights and privileges of any literary institution in the United States.”³⁰ In these early years of Santa Clara College, Italian-born Jesuits as well as several lay professors comprised the instructional staff, while the students were often children of Irish and Italian immigrants.³¹ As few other choices existed for higher education in the state, Santa Clara College attracted more potential students than it could accept. Beyond the sons of immigrant families, students came from the families of foreign consuls and members of California’s large landowners. In fact, as late as 1867 Santa Clara College had a Spanish version of its bulletin to reach out to the Californios, or the Spanish-speaking inhabitants of mainly Spanish descent who had lived in California prior to the United States assuming control. Californio parents sent their sons to Santa Clara College, in part, to learn English so as to be productive members of the new English-

²⁸Ibid., 29, 47.

²⁹“Santa Clara College—Incorporated,” *Daily Alta* (San Francisco), May 15, 1855, 2.

³⁰Santa Clara College, *Prospectus of Santa Clara College, with a Catalogue of the Officers and Students, for the Year 1854-5* (San Francisco: O’Meara & Painter, Printers, 1855), 3, Catalogues of Santa Clara College, 1851-52, 54-55 to 1860-61, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

³¹McKevitt, *The University of Santa Clara*, 2-3. Bernard J. Reid, “The First Year at Santa Clara College,” 1894, Bernard J. Reid Collection, Box 2A, Folder 10, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

speaking dominant populace. In fact during Santa Clara's first twenty-five years, of the 1,650 students enrolled at the college, a quarter were Hispanic.³²

Indeed, Santa Clara College was an example of multiculturalism and benefitted from transnationalism. Jesuit professors, European and predominantly Italian, had been trained in classical studies and based the school's curriculum on a European model transplanted to California. They utilized Americans to teach subjects such as literature and English. Heeding the needs of the local political economy, the leaders of Santa Clara College emphasized subjects that would be of practical value to their students. Bookkeeping, physics, and mineralogy, among others, were fields of importance to California and the West in general.³³ Besides Catholics in general, Santa Clara College and St. Ignatius College filled an educational void for both Californios and Protestants. Protestants also came in large numbers to Santa Clara College, making up half of the student body in 1868 with the institution being one of the most ecumenical schools in the West. Few Protestant educational institutions existed, and Protestant families also saw the value of the Jesuit educational tradition that their sons would receive at Santa Clara. Although some of the priests and Catholic students wished there were fewer or even no Protestants on campus, others saw the value of mixing religious cultures. For one, attending a Catholic school helped break down prejudices against Catholics and some Protestants even converted to Catholicism, a desirable outcome according to the priests. Additionally, Protestant students allowed the school to survive financially.³⁴ With the strong educational tradition of the

³²McKevitt, *The University of Santa Clara*, 37-40, 214.

³³McKevitt, *Brokers of Culture*, 1.

³⁴*Ibid.*, 210-211.

Jesuits and their adaptation to western needs, Santa Clara College and St. Ignatius College became an integral part of California's development.

Science at Santa Clara College

From the earliest years after Santa Clara College's founding, the school highlighted the role of science through both descriptions of scientific equipment and indications of the place of science at the institution. The yearly prospectus for the college gave updates on the acquisition of scientific equipment. For example, the 1854-55 *Prospectus* updated the status of obtaining scientific equipment by noting that "a complete philosophical and chemical apparatus, comprising all the recent improvements is daily expected from Paris."³⁵ Additionally, the school was also building "a cabinet or museum of natural history, in which particular attention is paid to whatever California offers that is new or interesting to the students in this department."³⁶ Paying "particular attention" to items from California shows that from the earliest years Santa Clara College endeavored to have the school focus on the needs and attributes of the state. In the *Prospectus*, the leaders of Santa Clara College indicated the significance of these developments by stating, "With these facilities and other contemplated improvements, the Fathers hope to make Santa Clara college a favorite abode of science, morality and religion."³⁷ Whether the Fathers of Santa Clara meant anything significant by listing science ahead of morality and religion is unclear. Nonetheless, science did assume a prominent place in their descriptions of the young

³⁵Santa Clara College 1854-55 *Prospectus*, 4.

³⁶*Ibid.*

³⁷*Ibid.*

school.

As subsequent publications from Santa Clara College show, science continued to be highlighted. The next year, 1856, the Santa Clara College *Prospectus* related that the philosophical and chemical apparatus ordered from Paris had partly arrived and that a new building “containing eight spacious class-rooms, and a well ventilated dormitory, one hundred and ten feet long and forty feet wide” had been completed.³⁸ By 1857, the *Prospectus* listed, along with the professors themselves, the philosophical and chemical apparatus as the most salient element of the college. The *Prospectus* described the faculty as “an able and numerous body of experienced Professors from the best Colleges of the Society [of Jesus], both in Europe and in the Atlantic States.”³⁹ Four “considerable advantages for the mental and physical training of the students” were also listed, with the first being “a complete philosophical and chemical apparatus, from the best manufacturers of Paris, which cost the Institution nearly ten thousand dollars” and the second “a large collection of specimens of minerals imported from Paris.”⁴⁰ These improvements in the apparatus and structure of Santa Clara College gave rise to the Fathers’ assessment of the school being elevated from *hoping* the college to be a “favorite abode” to them “*ventur[ing]* to think Santa Clara College to be a favorite abode of science, morality and

³⁸Santa Clara College, *Prospectus of Santa Clara College, with a Catalogue of the Officers and Students, for the Year 1855-6* (San Francisco: O’Meara & Painter, Printers, 1856), 3, Catalogues of Santa Clara College, 1851-52, 54-55 to 1860-61, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

³⁹Santa Clara College, *Prospectus of Santa Clara College, with a Catalogue of the Officers and Students, for the Year 1856-7* (San Francisco: O’Meara & Painter, Printers, 1857), 3, Catalogues of Santa Clara College, 1851-52, 54-55 to 1860-61, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

⁴⁰*Ibid.* The third advantage listed was “an artificial bathing pond” and the fourth was “an extensive gymnasium.”

religion in no way inferior to any other Institution in the country for the education of youth.”⁴¹

Again science placed first in the list of characteristics of Santa Clara College, and the Fathers felt they could compare with any other college in the country—quite a statement considering some of the educational institutions in existence on the East Coast.

One reason for the confidence expressed by the Santa Clara College leaders came from the scientific equipment the school was quickly accumulating. Evidently feeling the specifics of the equipment was important in marketing the school, the yearly prospectus began devoting pages to the equipment beginning with the 1856-57 *Prospectus*. Expressing what must have been excitement about their equipment, the college leaders listed in some detail the philosophical apparatus. The information given included the number of instruments or machines for different types of experiments. For example, experiments in mechanics had twenty-eight instruments, hydraulics had twenty-five, and pneumatics had fifty-two. Teaching surveying—an important skill for California’s political economy including mining and land claims—was aided by sixteen instruments. Fifty instruments, including eighteen Leyden jars, were available for use with electricity, which would later be a hallmark of the work of Joseph Neri, a professor at both Santa Clara College and St. Ignatius College.⁴²

⁴¹Ibid. (italics added).

⁴²Ibid., 3-4. The instruments for mechanics experiments included pulleys and an apparatus for centrifugal forces. The *Prospectus* noted that for hydraulics the machines included fountain and pump models, which would “especially attract the attention of visitors.” Other machines for experiments included those for caloric (sixty-six), acoustics (twenty), and chemistry (over 500 pure chemicals and “all the instruments necessary for the most complicated manipulations”). The school also possessed a complete apparatus for daguerreotyping as well as “nearly seven hundred specimens well classified and labeled” for a mineralogy museum with most of the minerals coming “from distant countries.” In the twentieth century, some of the equipment became part of the Smithsonian Institution’s collection. McKevitt, *Brokers of Culture*, 216.

Besides listing the different types of equipment and the types of experiments that could be done, the description also noted in a few cases the individuals associated with the equipment who had either refined a specific piece or who had done experiments with it. For instance, in the areas of galvanism and magnetism, machines listed included Faraday's magnetic apparatus improved by Rumkorf and other pieces of equipment that would reproduce experiments and prove theories of Ampere, Oersted, and others. In optics, the sixty-nine instruments included Duboscq's telescope and the type of sextant that had been used by France's Admiral Dumont Dorville in his expeditions.⁴³ This would indicate to readers that the school was keeping up with the latest in scientific trends and that the professors were well acquainted with major scientists and experiments. It would also seem to presuppose that at least some of the readers of the prospectus would have familiarity with the names mentioned, while other readers would likely assume the names mentioned were well respected leaders in their fields. That most of the parents of prospective students would have such a scientific background to recognize all the names and types of experiments seems doubtful so perhaps the prospectus was written with additional audiences in mind. In any case with all of this additional equipment, it cost students more to use the natural philosophy and chemistry instruments with the fee increasing from fifteen dollars in 1855 to twenty dollars two years later.⁴⁴

In the 1857-58 *Prospectus*, the list of scientific instruments remained the same (although the mineralogy museum now had about one hundred more specimens than the previous year) and the cost for using them stayed the same. However, the Father's description of Santa Clara

⁴³Ibid. The text has Empere instead of Ampere.

⁴⁴Santa Clara College 1854-55 *Prospectus*, 9; Santa Clara College 1856-57 *Prospectus*, 10.

College showed an increasing confidence as they went from “hop[ing]” to “think[ing]” to “now recommend[ing] Santa Clara College as a favorite abode of Science, Morality and Religion in no way inferior to any other Institution in the country for the education of youth.”⁴⁵ The next year, the *Prospectus* continued a trend of emphasizing science when it stated that the college now had “a complete philosophical [sic] apparatus, and chemical laboratory, furnished with all the means required for every kind of experiment or analysis.”⁴⁶ As in the prior years, the *Prospectus* once again listed in full the details of the scientific equipment.

With a complete set of scientific equipment, the faculty at Santa Clara College engaged with the mining industry of California and even Mexico. Nicola Congiato, a Jesuit leader in California, told his European superiors in 1863 that the laboratory at Santa Clara was ranked among the best in the country and had the best chemical laboratory in California. He also stated that this laboratory was the only one that could do needed chemical analyses, so people came to Santa Clara when they had an important analysis to be done, even coming from Mexico.⁴⁷ Various visitors wrote about their impressions of the school’s scientific equipment. For instance, a Scottish visitor was surprised to find more than 500 reagents in the philosophical cabinet and was greatly impressed by the various instruments from Europe. He summed up his visit by

⁴⁵Santa Clara College, *Prospectus of Santa Clara College, with a Catalogue of the Officers and Students, for the Year 1857-8* (San Francisco: O’Meara & Painter, Printers, 1858), 3, Catalogues of Santa Clara College, 1851-52, 54-55 to 1860-61, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

⁴⁶Santa Clara College, *Prospectus of Santa Clara College, with a Catalogue of the Officers and Students, for the Year 1858-9* (San Francisco: O’Meara & Painter, Printers, 1859), 3, Catalogues of Santa Clara College, 1851-52, 54-55 to 1860-61, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

⁴⁷McKevitt, *Brokers of Culture*, 216.

praising Santa Clara for the college being able to “educate students ‘according to the needs of the age.’ ”⁴⁸ Another visitor, this one from San Francisco, noted that Santa Clara had some of the only examples of certain equipment in the United States. For instance, he mentioned Santa Clara had the only replica in the country “of a famous European apparatus ‘for the liquefaction of gases’ ” and also stated that “a collection of ‘Gassiot’s tubes,’ used in ‘exhibiting the electric light in different gases’ ” was one of only two sets in the United States.⁴⁹ Thus, the reach of Santa Clara College extended well beyond the Bay Area and brought in visitors and those requiring services from a much larger geographic range as well as attracting new students.

Santa Clara College shared the acclaim for its scientific equipment with St. Ignatius College, which was also known for its laboratory. In 1880, the United States Bureau of Education conducted a survey of chemistry and physics curricula in 500 American colleges and universities. The survey ranked St. Ignatius in the top 120 superior institutions for its equipment, which was valued at the time at over \$50,000.⁵⁰ The report noted that students also aided in public lectures and demonstrations given by science professors.⁵¹ Not surprisingly, many of the same priests who had helped build up Santa Clara College’s scientific equipment and science curriculum had done

⁴⁸McKevitt, *The University of Santa Clara*, 71.

⁴⁹Ibid., 71-72.

⁵⁰McKevitt, *Brokers of Culture*, 217.

⁵¹Frank Wigglesworth Clarke, *A Report on the Teaching of Chemistry and Physics in the United States*, Circulars of Information of the Bureau of Education, No. 6-1880 (Washington, DC: Government Printing Office, 1881), 144, <https://drive.google.com/file/d/0B3rcT2urDUI3OTJyNzhjbE5jRkE/view>. This report also listed information on the California State Normal School and the University of California. It mentioned that data had not been received from Santa Clara College or the University of the Pacific as well as other colleges in California at the time.

the same at St. Ignatius College.

In Santa Clara College's 1858-59 *Prospectus*, a scientific course of study was added to the classical course with the difference being that the scientific (or "scientific" as it was termed) did not require the study of Greek or Latin.⁵² Along with the new course of study came a new degree to be awarded. While a bachelor of arts (A.B.) and a master of arts (A.M.) had been offered since the beginning, Santa Clara College now advertised the S.B. or baccalaureate of science.⁵³ Thus, after several years of promoting the institution as an "abode of science," a scientific degree could go along with that.

Even prior to the addition of the scientific course of study, Santa Clara College offered more than a single instructional course. In the 1854-55 *Prospectus*—the earliest available—two courses of instruction were listed. These courses—the "classical" and the "commercial"—both included such subjects as rhetoric, history, and geography. Each also had mathematics and scientific subjects as part of their curriculum, even before a separate scientific course was established. For the classical course, the students took classes in mathematics and natural sciences, while students in the commercial course had instruction in mathematics, natural philosophy, and chemistry. As might be expected from a "business education," this course required the students to study such practical subjects as surveying and mensuration.⁵⁴ These subjects would have been quite useful in early California as both would have been important in establishing land claims, for instance, and thus in Santa Clara College's connection to the

⁵²Santa Clara College 1858-9 *Prospectus*, 5.

⁵³*Ibid.*, 8.

⁵⁴*Ibid.*, 5.

political economy.

When the bachelor of science was added in the 1858-59 *Prospectus*, the “plan of instruction” added the “scientific” course and included the requirements for the three degrees that Santa Clara now offered. The Bachelor of Arts was “conferred on those only, who in completing the studies of Latin, Greek, English, Mathematics and Rational Philosophy, are found, after due examination, sufficiently qualified.”⁵⁵ The new “Baccalaureate of Science” was given to those who had “pursued the course prescribed for the Scientific Department, and after due examination is judged competent.”⁵⁶ The Scientific Department course, as previously stated, followed that of the classical course with the exception of Greek and Latin. The requirements for the Master of Arts was also given. “After some time devoted to the study of Natural Science, Moral Philosophy, Science of Government, and higher Mathematics, the degree of Master of Arts will be conferred upon such as shall have creditably passed a rigid examination.”⁵⁷ Of note is that the Master of Arts required further study in mathematical and scientific areas besides studies of moral philosophy and government.

Yet another way in which science was emphasized at Santa Clara College beginning with its earliest years in the 1850s was through the commencement exercises. The commencement programs, contained in the prospectuses for each year, listed examinations in various subjects, including mathematics and the sciences.⁵⁸ For the commencement ceremony itself, scientific

⁵⁵Ibid., 8.

⁵⁶Ibid.

⁵⁷Ibid., 8. Those taking the “commercial course” would receive a “Commercial Diploma” rather than a degree.

⁵⁸Santa Clara College 1854-55 *Prospectus*, 16-18.

fields were highlighted. The 1855 commencement, for example, included various statements in multiple areas, such as philosophy, natural theology, ethics, mechanics, chemistry, and physico-mathematics. Additionally, the 1854-55 *Prospectus*, with the program for that year's ceremony, noted the presentation of "Theses from Rational and Natural Philosophy, Chemistry and Physico-Mathematics, to be Maintained at the Fourth Annual Commencement of Santa Clara College, July 12, 1855."⁵⁹

The listing of "statements" and "examinations" in mathematics and scientific fields, as well as other subjects, for commencements continued in the prospectuses in future years. By the seventeenth annual commencement, a scientific lecture was considered entertainment for those in attendance. For instance, the "Programme of the Exercises at the Seventeenth Annual Commencement," noted that the "Evening Entertainment" for Thursday, June 25, 1868, would be in part "Scientific Lectures on The Atmosphere and its several functions in Nature."⁶⁰ Thus, through the early years, science was highlighted at Santa Clara College not just with publicity to attract new students but also at its most public of ceremonies, that of graduation.

In 1857, Santa Clara College granted the first bachelor of arts degree, which was also the first degree conferred by any California institution of higher education.⁶¹ As Kevin Starr notes

⁵⁹Ibid., 20-24.

⁶⁰Santa Clara College, *Catalogue of the Officers and Students of Santa Clara College, S. J., California for the Academic Year 1867- '68* (Santa Clara, CA: Santa Clara College S.J., Printing Office 1868), 22, Catalogue of Santa Clara College, 1861-1862 to 1871-1872, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

⁶¹McKevitt, *The University of Santa Clara*, 49. The first recipient of a bachelor's degree at Santa Clara College and in California was Thomas I. Bergin, who went on to study law in New York, practice in San Francisco, and become one of the first directors of the Hastings School of Law before he helped Santa Clara College found its School of Law in 1915. Ibid., 48.

that even as “New England ministers struggled futilely to found a college, the Jesuits of Santa Clara in June 1857 awarded California’s first bachelor’s degree. Protestant families began to send their sons to the Jesuits at Santa Clara and Saint Ignatius College in San Francisco.”⁶² Only a few years after statehood, Catholic education in California had taken a major step in providing higher education.

Some of the early graduates of both Santa Clara College and St. Ignatius College went on to have distinguished careers. Santa Clara graduated Delphin Delmas, a nationally renowned criminal lawyer and figure in the Democratic Party; James F. Smith, governor general of the Philippines; and Stephen M. White, U.S. Senator representing California. St. Ignatius College also had prominent alumni including brothers Matthew and Jeremiah Sullivan, who became California Supreme Court justices, and James D. Phelan, who served as mayor of San Francisco and U.S. Senator from California. Another St. Ignatius alumnus, Augustus J. Bowie, received a classical degree but went on to international acclaim in the field of hydraulic gold mining.⁶³ John J. Montgomery, an 1879 St. Ignatius College alumnus who had also attended Santa Clara College for a year, went on to work in aviation, including demonstrating a glider with wings imitating a seagull’s in 1883. The glider flew around three hundred feet in the first American demonstration of a heavier-than-air machine.⁶⁴ Thus, even the broader bachelor of arts degree provided a basis for scientific and technological accomplishments, besides those in other areas of society. While

⁶²Starr, 93.

⁶³McKevitt, *Brokers of Culture*, 213.

⁶⁴McKevitt, *The University of Santa Clara*, 137. For a biography of Montgomery, see Craig S. Harwood and Gary B. Fogel, *Quest for Flight: John J. Montgomery and the Dawn of Aviation in the West* (Norman: University of Oklahoma Press, 2012).

the success of these alumni cannot be attributed to solely the scientific training at the colleges, the overall curriculum and educational instruction, including that of science, can be seen as a foundation for the careers of the alumni.

Science Classes at Santa Clara College

From Santa Clara College's start, a number of mathematical and scientific courses were included in the curriculum. This inclusion was deliberate on the part of the school's leadership, who modified what they taught to meet the needs of the interests in California and thereby gave their students more scientific instruction than Jesuit colleges in other parts of the United States offered.⁶⁵ While this was congruent with the traditional Jesuit engagement with science, the Italians at Santa Clara also responded to the United States' and especially the West's greater need for technical and scientific instruction. Santa Clara College, St. Ignatius College, and other Jesuit schools in the western United States had been established following major mineral finds, and the local economies around the schools were based on the mining of gold and silver from the Sierra Nevada and the Comstock Lode.⁶⁶ "The Fathers recognize the fact that this is a mineral country,' a San Francisco journal reported in 1866, 'and that many of the pupils may become interested in mining development.' Apprentices were trained in assaying, a skill 'of highest importance here,' a priest told European officials."⁶⁷ This training was aided in no small part by the extensive scientific equipment that Santa Clara College had imported from Paris.

⁶⁵McKevitt, *Brokers of Culture*, 215.

⁶⁶Ibid.

⁶⁷Ibid.

In the yearly prospectus for Santa Clara College, the types of classes taught were listed. The *Prospectus* of 1854-55 named eight different “branches” of instruction, four of which dealt with mathematics and science. The first of these branches was “rational philosophy,” which had classes in logic, metaphysics, ethics, and natural rights. The second branch was that of the natural sciences. Classes in this branch were in natural philosophy, astronomy, natural history, meteorology, chemistry with its application to mineralogy, agriculture, arts and domestic economy, physiology, geology, and botany. Next came the branch of mathematics, which had classes in algebra; linear, plane, and solid geometry; surveying; mensuration; plane and spherical trigonometry; conic sections; analytical geometry; and calculus. Another branch included classes in arithmetic, as well as penmanship and bookkeeping. The other four branches were for the “Belles-Lettres,” history and geography, modern languages, and fine arts.⁶⁸

What was actually taught in the various branches and the classes that made up each branch is not evident from examining the prospectuses. While some books from that period have survived, even then it is not apparent what subject was taught for certain. Instead, studying records left by class participants would provide a better source. Unfortunately, such records, like journals or diaries, are rarely found.

The only known surviving diary by a student at Santa Clara College in the first few decades of the school’s existence is one by Jesús María Estudillo. Estudillo was a student in the early 1860s. He was born on June 29, 1844, at Rancho San Leandro as the eleventh and last child of Don Jose Joaquin Estudillo and the former Juana Maria del Carmen Martinez, Don Jose’s wife. At age eight, Jesús’s father died, and a few years later in September 1856, he entered Santa

⁶⁸Santa Clara College 1854-55 *Prospectus*, 4.

Clara College's Preparatory Department. He continued at Santa Clara College until 1864 when he had to drop out of school due to a lack of funds. Jesús kept journals throughout his years at Santa Clara College and beyond, from at least January 1861 through 1867, but unfortunately only the entries for the years 1861, 1862, 1864, and 1867 have been preserved.⁶⁹ These diaries that have survived describe his daily life including his classes, exams, and working with professors as well as his personal feelings and thoughts about life on and off campus.

During the school year, Estudillo's diaries largely contain references to his day in school and what his classes consisted of as well as his extracurricular activities. Estudillo was a fairly good student and one interested in science. He often described his science classes and experiments conducted in those classes by either the professor or Estudillo and his fellow students. Estudillo also subscribed to several newspapers and magazines, including *Scientific American*. Thus, Estudillo's journals provide a useful way of understanding what life was like at Santa Clara College in these years and in particular insights into some of the scientific activities that took place at the college.⁷⁰

⁶⁹Margaret Schlichtmann, Preface and Acknowledgments, in *The Journals of Jesus M. Estudillo*, ed. and annotated by Margaret Schlichtmann (Fredericksburg, TX: Awani Press, 1988), ix-x. *The Journals of Jesus M. Estudillo* was primarily edited and annotated by Margaret Schlichtmann, but she died before the work could be completed. Marie Wilson completed the project. The book contains a fairly complete transcript of Estudillo's journals from 1862. However, while Estudillo recorded an entry on every single day of the year, the book skips over some days and only transcribes portions of other days; nonetheless, the book does provide valuable historical background of both Estudillo and the time. Thus, for any researcher that wants to get a more complete picture of Estudillo and read his entries on every day of 1862 as well as his entries for 1861, 1864, and 1867, the researcher must turn to the original handwritten journal entries that are available on microfilm.

⁷⁰For additional historical context on Estudillo and what it can demonstrate about life for Californios in this period, see Gerald McKevitt, "Hispanic Californians and Catholic Higher Education: The Diary of Jesús María Estudillo, 1857-1864," *California History* 69, no. 4 (Winter 1990/1991), 320-331.

Among the tidbits that Estudillo recorded in his journal relating to science at Santa Clara College include examples of assigned problems and class lecture topics. For instance, in his entry for Saturday, January 12, 1861, he mentions that he had an arithmetic test and one problem was as follows: “The sum was if you rent 1 acre of land at \$7 but if you find that there’s but 7/8 of an acre how much will you pay for it.”⁷¹ In the first half of 1861, he was still in the preparatory department, and the subjects Estudillo studied were relatively basic. He took bookkeeping and in arithmetic he studied fractions, among other subjects.⁷² Even when not in school, Estudillo cultivated an interest in science. On Monday, August 5, 1861, before the new school year had begun, he attended a lecture by a Dr. C. H. De Wolfe on phrenology and physiology.⁷³

Returning to school for the 1861-62 school year, Estudillo took chemistry and natural philosophy in addition to mathematics. Several times he mentioned his enjoyment in seeing chemistry experiments performed by his professors.⁷⁴ Some experiments involved oxygen and hydrogen gases and phosphate of calcium. Other lectures in chemistry touched on subjects such as metallic elements and artificial light. The chemistry class also attended a talk off campus, where they heard a lecture on electricity. Estudillo’s natural philosophy class covered a variety of

⁷¹Jesús María Estudillo, diary, January 12, 1861, Jesús María Estudillo Diaries, The Bancroft Library, University of California, Berkeley, microfilm.

⁷²For example, see his diary entries for March 1, 1861, and June 3, 1861. The only documents that Santa Clara University Archives has on Estudillo are some of his exercise books for his accounting and bookkeeping classes. These can be found in the Student Development Box 1, Estudillo, J[esus] M[aria] folder, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

⁷³Estudillo diary, August 5, 1861.

⁷⁴See Estudillo diary for October 1, 1861; October 11, 1861; and October 25, 1861, for example.

scientific topics, ranging from acoustics to electricity.⁷⁵ Experiments in the class included examining “Liquids or Non-Elastic Fluids in motion,” while others utilized equipment, such as the air pump for exploring properties of air and finding out that “a body weighs less when the air is exhausted than when the air is in it.”⁷⁶ Other scientific equipment that was used in instruction included the pendulum, electrometer, cylinder machine, plate machine, Leyden jar, and the “Magic Lantern.”⁷⁷

Outside of formal classes, topics related to science came up in school activities. For instance, in the catechism class on Sunday, October 27, 1861, the students had to write a composition “to prove the existence of God by four philosophical questions,” namely using the existence of humans, plants, the human soul, and the motion of celestial bodies.⁷⁸ In the debating society that Estudillo was a member, one debate featured the topic of “whether the use of animals was more useful than that of metals”; at least in this debate metals won.⁷⁹ Sometimes events of the outside world invaded the science classes, or at least intersected, such as on Tuesday, May 6, 1862, when Estudillo recorded, “During the chemistry class, our professor employed the hour of the class speaking more about political matters than on platinum, spoke about the approaching war that would be in the whole of Europe, then of iron-clad vessels.”⁸⁰ With the Civil War fully

⁷⁵Ibid., November 5, 1861; December 11, 1861; January 28, 1862; March 12, 1862; October 23, 1861; March 29, 1862; and April 7, 1862.

⁷⁶Ibid., February 8, 1862; February 15, 1862; and February 17, 1862.

⁷⁷Ibid., April 7, 1862; April 12, 1862; April 14, 1862; April 21, 1862; April 26, 1862; and June 16, 1862.

⁷⁸Ibid., October 27, 1862.

⁷⁹Ibid., January 30, 1862.

⁸⁰Ibid., May 6, 1862.

engaged and the battle of the *Monitor* and *Merrimack* having taken place only weeks earlier, it would not be surprising to see topics such as this enter the classroom and into a science classroom at a time when the latest technology was being employed in the war.

St. Ignatius College⁸¹

Besides Santa Clara College, St. Ignatius College was the other Jesuit college in the San Francisco Bay Area. Located in San Francisco, it admitted its first pupils on Monday, October 15, 1855, with Anthony Maraschi, previously a professor of mental philosophy at Baltimore's Loyola College, heading up the institution. Four years later, the Society of Jesus officially recognized St. Ignatius as a college, which led to the college's leaders incorporating the school under California law.⁸² While less specific evidence is available for St. Ignatius than Santa Clara, what is available provides a general sense of the culture and place of science at the school.

Much like Santa Clara College, St. Ignatius College's physical cabinet was equally impressive as by July 1860 Maraschi listed it contained " 'a steam engine; an electric machine

⁸¹Unfortunately, far fewer primary sources exist on the early history of St. Ignatius College due to the 1906 San Francisco earthquake and fire. However, from the primary and secondary sources available, it is apparent that similar educational conditions existed as at Santa Clara College and that St. Ignatius College benefitted from Santa Clara being founded first and located relatively nearby.

⁸²Joseph W. Riordan, *The First Half Century of St. Ignatius Church and College* (San Francisco: H. S. Crocker Company, 1905), 69, 76, 93, UCLA Library Special Collections, Charles E. Young Research Library, University of California, Los Angeles. Although this is an older book, it provides one of the best resources for the early history of St. Ignatius College. It contains the texts of numerous documents that were lost in the 1906 San Francisco earthquake and fire that destroyed many of the records of St. Ignatius College. While Riordan's book includes the only known record of some documents, he, unfortunately, did not provide complete bibliographic citations for his sources.

and appendices; an air pump and appendices; . . . a theodolite; a compression fountain.’⁸³ Soon after that a telescope was purchased, which was known to be the best in California for a number of years. Although Santa Clara College had extensive scientific equipment earlier, St. Ignatius College achieved a similar quality of equipment. Anthony Cichi, a chemist, expanded the chemistry department in 1863 by purchasing, among other equipment, a photographic apparatus. By 1870, the school possessed a chemical laboratory, assaying office, and a museum of mineralogy and natural philosophy. Additionally, like at Santa Clara, the scientific department had advanced equipment from Paris, which would be able to perform complicated analysis and manipulation.⁸⁴

Joseph Neri and Joseph Bayma were professors at St. Ignatius (and also faculty members at Santa Clara at different times), and both did much to advance science there. They purchased equipment from the famous Parisian manufacturer Dubosque and bought induction coils and other instruments from Ritchie of Boston. With such expensive equipment being purchased, various means were sought to cover the costs. An attempt at this was done through public lectures. While the lectures were not financially successful enough to pay back the cost of the equipment, the lectures were instrumental in shaping perceptions of the college in San Francisco.⁸⁵

As Santa Clara College had done about fifteen years earlier, St. Ignatius College began offering a bachelor of science degree in 1873. Likewise, the degree at St. Ignatius had equivalent

⁸³Ibid., 94.

⁸⁴Ibid., 95, 133, 162.

⁸⁵Ibid., 165.

requirements as at Santa Clara, offering the same classes as for the bachelor of arts with the exception of Greek and Latin. The following year, the scientific department's equipment was expanded with the purchase from Paris of an electro-magnetic machine, which was the first in the United States. It cost more than \$5,000, which had been mostly donated by "patrons of science and education."⁸⁶ The machine, exhibited in April of that year, had an electric light regulator, spherical mirror, and Fresnel lens, and was said to be able to project light for two hundred miles to distant parts of the San Francisco Bay region.⁸⁷ This electro-magnetic machine was the same type of machine as had been used for defensive lighting in 1871 during the second siege of Paris in the Franco-Prussian War. Neri worked to improve the machine by having a storage battery supply electric current to the machine's magnets, which strengthened them.⁸⁸ A couple years later in 1876 as part of that year's Mechanics' Institute Industrial Fair, the exhibit for St. Ignatius College showcased the school's scientific equipment, which was greatly responsible for the success of the school's participation.⁸⁹

While much more could be said about St. Ignatius College, clearly, science was an integral aspect of St. Ignatius just as at Santa Clara. With so many of the same individuals appearing on the lists of faculty at both institutions and with the same Jesuit background, it should not be surprising that science had a prominent place at both institutions. Being in California's leading city San Francisco, St. Ignatius College achieved a different type of prestige

⁸⁶Ibid., 191, 193-194.

⁸⁷Ibid., 194.

⁸⁸Harwood and Fogel, 15.

⁸⁹Riordan, 202-203.

as it interacted with its community and aided in its growing prosperity.

Science Faculty

Those doing the actual teaching of science and all other classes were also recorded in the prospectuses. In general, as might be expected at a Jesuit institution, and as exemplified in the 1854-55 *Prospectus*, most of the faculty were listed as being reverends and as a member of the Society of Jesus.⁹⁰ Additionally, many of the faculty members were from Italy. In fact, John Nobili, a founder of Santa Clara College, had been born and educated in Rome. He authored books on physics and mathematics.⁹¹ A reason the professors were predominately Italian in origin was, as stated previously, the adoption of California as the permanent mission of the Jesuits of the Province of Turin, Italy. These Jesuits were university educated and provided a significant boost to the young school. Before this, the institution barely had enough faculty to sustain itself and not enough teachers to expand the curriculum to offer a full collegiate course of study. The arrival of faculty from Italy allowed Santa Clara College to embrace a college curriculum. Santa Clara College was not alone in needing faculty from Europe. While non-Catholic colleges utilized both Americans and Europeans educated in Europe, Catholic colleges in general, and Jesuit ones in particular, relied on professors from Europe.⁹² Santa Clara's Jesuit professors had generally notable academic backgrounds with most of them serving in European or eastern

⁹⁰Santa Clara College 1854-55 *Prospectus*, 11. This was done with "Rev." being listed before their names for reverend and/or having "S.J." appear after their names indicating they were a member of the Society of Jesus.

⁹¹Ferrier, 203.

⁹²McKevitt, *Brokers of Culture*, 208-209.

United States colleges before working in California.⁹³

A number of the professors at both Santa Clara College and St. Ignatius College had various areas of distinction with regard to science, technology, and the California political economy. The professors' activities ranged from their classroom teaching to writing in periodicals to engaging with the local community. Two of the first three Jesuits to come to California were Charles Messea and Aloysius Masnata, both of whom arrived in November 1854.⁹⁴ Messea became the professor of chemistry, while Masnata was the professor of natural sciences and ancient languages. A third priest, Francis Veyret, taught the other mathematics and science courses as the professor of mathematics, physics, and astronomy.⁹⁵ Unlike Messea and Masnata and many of those who taught in subsequent years, Veyret was a native of France, not Italy.⁹⁶

A candid look at some of the professors is found in Estudillo's diaries. For instance, Estudillo noted that for Professor Messea things in class did not always go as planned. One example came in a chemistry class when Messea "tried to make Soda water, but did not succeed on account of the instrument; or that there was not enough Tartaric acid mixed with Carbonic acid."⁹⁷ A few weeks later Messea was able to make up for this when he "succeeded in obtaining a great quantity of gas. All the boys crowded in the chemistry room to see it burn."⁹⁸ At the end

⁹³Ibid., 209.

⁹⁴McKevitt, *The University of Santa Clara*, 47.

⁹⁵Santa Clara College 1854-55 *Prospectus*, 11.

⁹⁶McKevitt, *The University of Santa Clara*, 87.

⁹⁷Estudillo diary, February 11, 1862.

⁹⁸Ibid., March 10, 1862.

of the school year, the class finally succeeded in making soda water, which resulted in “all the class [drinking] a glass of it.”⁹⁹ Messea also had his students engage with mining by having them do “an analysis on the silver ores and . . . write a lecture upon the analysis of the silver ore of Washoe.”¹⁰⁰ The subject of the Washoe silver ore also came up at the year-end public exhibition in one of the student lectures, along with one on artificial lights and another on California gold. Estudillo also had to do term lectures in chemistry on artificial lights, experiments on gases, and the Washoe silver ore analysis.¹⁰¹ One other example of a topic that corresponded with the political economy came in Estudillo’s mathematics class which studied mensuration.¹⁰²

Another one of the founders of Santa Clara College, Michael Accolti, was interested in a different application of science, that of agriculture. In the 1860s, Accolti wrote several letters and articles concerning agriculture. These letters were addressed to Colonel James L. Warren, editor of the *California Farmer*, the publication for which Accolti wrote.

With regards to agriculture and farming techniques, Accolti wrote on issues that he felt were “not of a little consideration in farming business, and domestic economy.”¹⁰³ His letters and articles contained information he had gleaned from farmers as well as his thoughts on agriculture and sometimes how he viewed farming in relation to Christianity. For instance, Accolti noted a tip he had received from an “old farmer” who told him “that if wheat is sown in adobe land,

⁹⁹Ibid., June 17, 1862.

¹⁰⁰Ibid., April 4, 1862.

¹⁰¹Ibid., May 13, 1862, and May 17, 1862.

¹⁰²Ibid., May 7, 1862.

¹⁰³Michael L. Accolti to James L. Warren, April 1865, James L. Warren Papers, Box 1, BANC MSS C-B 418, The Bancroft Library, University of California, Berkeley.

before rain, at the first showers the seed suffers damage [sic] in the same way as it would by frost.”¹⁰⁴ Providing such information for the local conditions went along with Accolti’s aim that the system of agriculture in California should not be imported but rather one “of our own characteristic of California, and peculiarly adapted to our own circumstances.”¹⁰⁵ He thus was concerned specifically with California’s growth as it related to agriculture and how local conditions could necessitate changes from what immigrants to California may have previously practiced. One solution for this was to have the farmers “enlightened and guided by the intelligence of their betters, lest they take a wrong way.”¹⁰⁶ To this end, Accolti viewed the *California Farmer* as integral in that process as it “is pregnant with most useful informations, [sic] and is the best calculated for educating our farming classes, according to the rules of Science, and the wisdom of experience.”¹⁰⁷ Here, Accolti connected the theory of agriculture with the practical process that would result from farmers receiving a proper education.

In this letter, which it seems Accolti intended to be published as an article in the *California Farmer*, he discussed his views on agriculture. He mentioned his desire for intelligent farmers, who would raise a variety of products rather than just grain that could fail. Accolti also wanted to have well-kept homesteads. This would require some work, but Accolti believed that “in His [God’s] plan the immediate destination of man is not rest and idleness; . . . but man is

¹⁰⁴Michael L. Accolti to James L. Warren, April 12, 1866, James L. Warren Papers, Box 1, BANC MSS C-B 418, The Bancroft Library, University of California, Berkeley (underlined in original).

¹⁰⁵Michael L. Accolti to James L. Warren, April 10, 1865, James L. Warren Papers, Box 6, BANC MSS C-B 418, The Bancroft Library, University of California, Berkeley.

¹⁰⁶Ibid.

¹⁰⁷Ibid.

made for labor and work.”¹⁰⁸ This marks one of the few places where one of the Jesuit educators made a direct connection between science and religion.

In a state whose population grew much with people believing they could get rich quick, Accolti warned against idleness by writing that “one of the greatest mistakes with our people here is that almost every body thinks that he may become rich all at once, and with the least work possible, and wonders why he could or should not.”¹⁰⁹ Instead, attention needed to be paid to such topics as farming in adobe land, droughts, cattle, horses, and the cultivation of sugar beets. Accolti found sugar beets to have much potential for profit. The cultivation of grapes for wine also gave Accolti hope that native red wine would be better for the health of individuals as opposed to “soul-debassing [sic] and body-killing distilled liquors.”¹¹⁰ Other advice Accolti gave concerned the cultivation of locust trees, for which he saw several uses including “certain kinds of carpentry works, especially in ship building and for strong fences.”¹¹¹ A farmer who “planted ten acres of land in proper order, with these beautiful trees . . . would, within ten or twelve years get a faire income by cutting down a certain number of trees for timber to be brought into market.”¹¹² This corresponded to Accolti’s general principle that “whatever article we raise, no matter how good it may be, let us raise it within the limits of proper discretion, and not be illuded by the rose-colored prospects of big profits . . . thus our labors will be abundantly remunerated;

¹⁰⁸Ibid.

¹⁰⁹Ibid.

¹¹⁰Ibid.

¹¹¹Ibid.

¹¹²Ibid.

otherwise we will overstock the market, only with few items, and thus ruin ourselves.”¹¹³ Accolti promoted a diversification of agricultural crops and a diversified economy in general.

Joseph Bayma was another Santa Clara College faculty member who had made a name for himself before arriving in California. He was a polymath with expertise in mathematics, philosophy, and theoretical physics. Prior to coming to California, he had authored scholarly publications, starting “with *Elements of Molecular Mechanics*, published in London in 1866,” which along with his other writings “earned him recognition as a pioneer in stereochemistry” and recognition as the leading Jesuit intellectual in California.¹¹⁴ With this book and other writings, Bayma formulated a hypothesis that the Daltonian atom was not the basis of physical reality but instead the basic unit was “ ‘a large number of simple, unextended, quasi-material, primary point-particles’ of force.”¹¹⁵ In *Realis Philosophiae*, he tried to bring together scientific theory of the day with scholasticism and the metaphysics of Thomas Aquinas, something that his superiors believed would never be approved by ecclesiastical censors. They encouraged him to leave Europe where he could have a fresh start to his career.¹¹⁶

In 1869, Bayma left Liverpool for San Francisco and became president of St. Ignatius College, where his scientific interest was evidenced through his expansion of the college’s laboratories, lecture halls, and scientific equipment.¹¹⁷ The head of the Jesuit order, Pieter Beckx, noted his pleasure in knowing that Bayma was happy to be at St. Ignatius and wished Bayma to

¹¹³Ibid.

¹¹⁴McKevitt, *Brokers of Culture*, 209.

¹¹⁵McKevitt, *The University of Santa Clara*, 112.

¹¹⁶Ibid.; McKevitt, *Brokers of Culture*, 110.

¹¹⁷McKevitt, *The University of Santa Clara*, 112.

do good work for the Jesuits.¹¹⁸ In 1880, Bayma, then sixty-five and in poor health, was transferred to Santa Clara College, where he soon recovered.¹¹⁹

There at Santa Clara as professor of mathematics for the final twelve years of his life, Bayma wrote five mathematics textbooks, including some on beginning geometry, analytical geometry, and trigonometry.¹²⁰ In the preface to his geometry text for beginners, he stated his purpose in authoring this book. While agreeing that “comprehensive books are very useful in the hands of those whose minds are already formed,” he had found that “experience has taught us that a judicious parsimony proves more successful in encouraging the mental efforts of young beginners, amid the many difficulties arising from the giddiness natural to the age, as well as from the number of their scholastic duties.”¹²¹ Through his textbooks, Bayma sought to make the works accessible and useful to the various levels of students and thereby providing younger students with a firm basis for learning mathematics and science. Although not all of the professors at either Santa Clara or St. Ignatius were as accomplished and published as Bayma, his scholarly output shows the level of scientific minds that were present on the campuses.

Another application of science, and one with significance to industrialization, was

¹¹⁸Pieter Beckx to Giovanni B. Ponte, July 12, 1869, Correspondence to/from Jesuit Fathers General, Rome, and California Mission Superiors and Provincials, Box 1, California Jesuit Archives, Santa Clara, CA.

¹¹⁹McKevitt, *The University of Santa Clara*, 113.

¹²⁰Ibid.

¹²¹Joseph Bayma, *Elements of Geometry: For the Use of Beginners* (San Francisco: A. Waldteufel, 1885), 5, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA. This text and others authored by Bayma are in the Santa Clara University Archives. Other texts by Bayma in the Santa Clara University Archives include *A Treatise on Plane and Spherical Trigonometry with Logarithmic Tables* (San Francisco: A. Waldteufel, 1886) and *Elements of Analytic Geometry* (San Francisco: A. Waldteufel, 1887).

electricity. Aloysius Varsi was one of the professors who worked with electricity. After first studying to become a Jesuit in a town near Turin, he continued his studies in Belgium and France. Varsi distinguished himself in mathematics and science and furthered his education in Paris. Coming to the United States in 1862, he first served as a chaplain in the Civil War. He later taught at Georgetown College and Boston College, and while in Boston he gave what may have been the first public lectures on electricity with experiments. Subsequently he became a professor of physics and mathematics at Santa Clara College and later was appointed president of the same academic institution.¹²²

Joseph Neri was another professor notable for his work with electricity as well as assaying. He, along with other Jesuit professors, taught at both Santa Clara College and St. Ignatius College. With a background in physics and chemistry, he gained knowledge and skill in mineral analysis and assaying by studying with professional assayers in San Francisco. Subsequently, he headed up the science department at Santa Clara College before later returning to San Francisco and St. Ignatius College.¹²³

Neri appeared frequently in the diaries of Estudillo, as Estudillo described his family's engagement in the political economy of both California and Nevada through their involvement with mining, such as his brother's connection with the Washoe silver mines in Nevada.¹²⁴

¹²²Richard A. Gleeson, "A Tribute: Rev. Aloysius Varsi, S. J.," in *My Golden Jubilee Thoughts* (1927), 17-19, California Biography Collection, Aloysius Varsi folder, California Historical Society Archives, San Francisco, CA. Varsi was born on March 9, 1830, on the island of Sardinia.

¹²³McKevitt, *The University of Santa Clara*, 71.

¹²⁴For example, Estudillo recorded that his brother "Jose Antonio came from Washoe last night," Washoe being the location of silver mines in the Territory of Nevada. Jose Antonio had apparently caught the "Washoe Fever" as had many other miners in the hopes of striking it rich.

Estudillo showed an interest in mining, as when on September 10, 1862, not long before he would enter another year of school at Santa Clara College, he went that afternoon “to see the copper mine in the hills which [he] found to [his] own knowledge that it was very rich.”¹²⁵ Finding some promising stones, he “brought some specimens to take to Santa Clara.”¹²⁶ In many entries during the following months, he recorded his work on the analysis of the copper that he had obtained. He first turned to Neri on October 17, hoping to have him do the analysis but asked another professor for assistance three weeks later when Neri did not have enough time. Finally, about two weeks after that the analysis was completed.¹²⁷ Estudillo wrote in his journal that he had sent a letter detailing the result of the analysis which showed that the ore’s copper content was “thirty and a little more” percent.¹²⁸ More than a year later beginning in January 1864 (unfortunately the journal for 1863 has not been found), Estudillo was again working on copper analysis, this time with Neri.¹²⁹ By January 29, Estudillo had finished his analysis, although the results were not what he had hoped; he suspected that there must have been a “mistake somewhere for [he] found only twelve percent and the mineral [copper] was very rich.”¹³⁰ Estudillo continued this interest and work with mineralogy when he left Santa Clara College in

Estudillo diary, August 2, 1862; Schlichtmann, 92.

¹²⁵Estudillo diary, September 10, 1862.

¹²⁶Ibid.

¹²⁷Ibid., October 17, 1862; November 7, 1862.

¹²⁸Ibid., November 19, 1862.

¹²⁹See for instance Ibid., January 7, 1864; January 16, 1864; January 19, 1864; January 20, 1864; and January 22, 1864.

¹³⁰Ibid., January 29, 1864.

1864 and became more directly involved with the political economy of California and Nevada by using the knowledge he had learned at school.

During the spring of 1864, Santa Clara College had some visitors, whose interests related to the work that Neri and Estudillo were doing. As Estudillo recorded it, “We had the honor of having been visited today by Professor Benjamin Silliman Jr. with two other . . . gentlemen, I believe one Englishman. They went through the College and remained in the Cabinet for a lengthy time.”¹³¹ This Santa Clara visit by Silliman Jr. on April 13, 1864, coincided with his visit to California as a mining consultant. For a number of years, he had been practicing as a scientific consultant in addition to his teaching responsibilities at Yale. He initially came to California in 1864 to serve as a consultant at the start of an oil boom. In April, he traveled to San Francisco in part to lend his name and scientific knowledge to the Washoe silver mining endeavor,¹³² the same mining area that Estudillo’s brother had been involved with a couple years earlier. There is no record of what Silliman Jr. did while visiting Santa Clara (other than visiting the Cabinet) and no mention of what might have been discussed with Neri or other professors or students, including Estudillo. Nonetheless, it is suggestive that a leading scientific consultant of the day visited the school, where Neri taught and had his own consulting business and where Estudillo, and likely other students, had interests in the mining fields.

Even after Estudillo had left Santa Clara, he and Neri continued to stay in contact. Neri had been working to provide financial support for his science department by performing assays for miners, and he called upon former students to help him with this. Estudillo, now in Virginia

¹³¹Ibid., April 13, 1864.

¹³²Paul Lucier, *Scientists & Swindlers: Consulting on Coal and Oil in America, 1820-1890* (Baltimore, MD: Johns Hopkins University Press, 2008), 115, 273, 278.

City in Nevada Territory, received a letter from Neri in October 1864.¹³³ The letter contained a request from Neri asking Estudillo to “distribute his circular letter amongst the presidents and superintendents of the principal mines of the Territory.”¹³⁴ Estudillo responded that he would try to do so, and evidently his and other advertising efforts paid off, with Neri performing “as many as six hundred assays a year.”¹³⁵ Through his work with students like Estudillo and with his own initiative, Neri had a direct action on the political economy as he participated, albeit from a distance, in the mining industry. Undoubtedly, as the case of Estudillo demonstrates, Neri’s and other professors’ teaching and scientific knowledge contributed to their students being able to work in the mining fields. This knowledge and the equipment housed at Santa Clara also garnered such a reputation that individuals such as Silliman Jr. would want to visit and miners would make use of the assaying services that Santa Clara College could provide.

Neri’s contribution to California’s development was not limited to work with assaying. Shortly after Neri’s death in November 1919, the then president of Pacific Gas and Electric, John Britton, wrote an article praising Neri and his work and stated that it was Neri who first introduced electricity into California.¹³⁶ While Neri’s most public work with electricity came in 1876 with the Centennial Exhibition, prior to this he had demonstrated electricity at St. Ignatius College. There, Neri had installed carbon electric lights and an electric lighting system in 1869.

¹³³McKevitt, *The University of Santa Clara*, 71.

¹³⁴Estudillo diary, October 26, 1864.

¹³⁵Ibid.; McKevitt, *The University of Santa Clara*, 71.

¹³⁶John A. Britton, “’Twas a Priest Introduced California to the Electric Light,” in *San Francisco Celebrates the Diamond Jubilee of Saint Ignatius College 1855-1930* (1930), 38, San Francisco Ephemera Collection, Saint Ignatius College folder, California Historical Society Archives, San Francisco, CA.

Five years later, a searchlight was added to the college's tower and "whose rays could be seen in all the bay cities, much to the wonderment of the inhabitants."¹³⁷ Another electric arc light demonstration took place in 1871, when Neri placed one in a college window in honor of Pope Pius IX's silver jubilee.¹³⁸ It was, however, at the San Francisco Centennial Exhibition of 1876 that Neri's electrical work was most on display. On July 4, 1876, Neri strung electric arc lights and reflectors across Market Street by St. Ignatius College in honor of the nation's centennial. This public illumination of electricity was the earliest demonstration in the world by a decade.¹³⁹ Neri's contribution to San Francisco helped make the city aware of electricity and its potential uses. Although his demonstrations did not lead to a local electrical industry (electrical and lighting equipment was still imported from the East or Europe), by 1879 the California Electric Light Company had been established in San Francisco, giving the city the distinction of having one of the first electrical utilities in the world.¹⁴⁰

Joseph Neri also worked with San Francisco's Mechanics' Institute, where he presented a series of lectures on electricity. His lectures focused on such subjects as electricity and its uses, including for lighting and electric railroads. Large crowds came to hear him, interested in his descriptions of scientific discoveries.¹⁴¹ He also gave other public lectures at St. Ignatius, including one such lecture series in 1873 on spectrum analysis, which was according to San

¹³⁷Ibid., 39.

¹³⁸David E. Nye, *Narratives and Spaces: Technology and the Construction of American Culture* (New York: Columbia University Press, 1997), 29.

¹³⁹Kevin Starr, *California: A History* (New York, Modern Library, 2007), 253.

¹⁴⁰Nye, 29-30.

¹⁴¹Britton, 39.

San Francisco's *Mining and Scientific Press* "the most thorough and complete course of scientific lectures ever delivered in this city."¹⁴² Indeed, the weekly newspaper reported that the series of five lectures that Neri gave had "constantly increasing interest and enlarged attendance at each succeeding lecture, to say nothing of the special and unanimous demonstration by the audience, on one occasion, when the lecturer proposed to cut short the most lengthy session of the series."¹⁴³ Thus, according to this weekly paper devoted to mining and technical issues, Neri's lectures were well received and popular with San Francisco residents. Some of Neri's other electrical work included the use of large batteries, magnetic machines, and dynamos as well as being the first to have a brush machine, storage battery, and a magnetic electric machine in California.¹⁴⁴ However, Neri, and in general his Jesuit colleagues, did not publish their research, preferring instead to engage the public through demonstrations and lectures.¹⁴⁵ While publishing might have given them more professional and scientific prestige, these Jesuits applied their knowledge and skills to not just academic pursuits but to the lives of ordinary people, who would have a direct effect on the political economy.

¹⁴²"The Alta as a Scientist—the Late Lectures on Spectrum Analysis," *Mining and Scientific Press*, May 3, 1873, 281, <https://ia600807.us.archive.org/17/items/miningscien26unse/miningscien26unse.pdf>.

¹⁴³Ibid. The *Mining and Scientific Press* was in part not just reporting on the series of lectures but also responding and critiquing a report by the *Daily Alta* that criticized Neri's lectures.

¹⁴⁴Britton, 39.

¹⁴⁵McKevitt, *Brokers of Culture*, 217.

Conclusion

The involvement with California and its growth by professors, such as Neri, and students, such as Estudillo, demonstrates the direct connection that was made between educational institutions such as Santa Clara College, their professors, and the political economy. While it is not possible to ascertain how many of Estudillo's classmates during this period engaged in similar types of activities, what Estudillo's journals reveal is a direct linkage between the local political economy and a higher education institution. Clearly, what the professors were teaching to students such as Estudillo was valuable knowledge for working in California's developing industries. Professors such as Neri had the expertise, and Santa Clara College had the scientific equipment to allow analysis of mineral ores to be performed. In a time when mining was still a major part of the California (and Nevada Territory) economy, having a knowledgeable source and equipment that could provide accurate information about the analysis of ores would have been invaluable.

Warning against too much confidence in mining instead of paying proper attention to manufacturing and agriculture, Accolti, in his letter to the editor of the *California Farmer*, advocated for the interests of California in the way he believed would help the state prosper. He wanted to see the natural wealth of California be used to develop the new state. Highly critical (for unknown reasons) of mining capitalists, Accolti wrote that metal extracts from the mines went "into the hands of few capitalists, who, generally speaking, live out of the country, and all the rest of the people are nothing but slaves of labor for the benefit of capitalists. Only agriculture and manufactures will make us rich, wealthy and independent."¹⁴⁶ This emphasis on agriculture

¹⁴⁶Accolti to Warren, April 10, 1865.

and manufacturing came even as Accolti wrote this letter from Santa Clara College that taught courses related to mining and had professors who were involved with mining. No matter how much mining may have been crucial to the establishment of California as a state, by the mid-1860s one of Santa Clara College's founders turned to other means as a possibility for continuing to growing the state and the nation. Looking back, Accolti's stress on agriculture seems prescient as California became a leading world agriculture producer. However, Accolti could not have imagined what would lie in the future, although he dared to dream of future greatness. "Yes, only on agriculture and manufactures are based the hopes of our future greatness, provided the people at large are raised to the sense of the importance of these two branches of national prosperity, and know how to develop the natural resources of this magnificent country."¹⁴⁷ The differing interests of Michael Accolti and Joseph Neri highlight that the Jesuits at Santa Clara College and St. Ignatius College were interested in a wide range of aspects of the political economy of their adopted state.

Science, however, did not continue to have such a place of prominence in the Jesuit colleges for the rest of the nineteenth century. Rather, the success of science and its applications at Santa Clara College and St. Ignatius College was its downfall. After the push of science by the leaders of the colleges, the leaders of the Society of Jesus pushed back against the schools. Removed from local conditions in California, the Jesuit hierarchy did not fully understand the needs of that population and instead emphasized the traditional classical curriculum, while the schools had focused on science in spite of the hierarchy and their beliefs. This occurred just as by the mid-1880s and into the 1890s, Latin and Greek were waning in general popularity as

¹⁴⁷Ibid.

subjects, and Santa Clara College and St. Ignatius College had increased competition from the University of California, Stanford University, and a number of other colleges both in the Bay Area and increasingly in Southern California. Additionally, the Jesuit colleges' educational content was seen as in need of improvement.

How to improve the educational quality and what to do about declining interest in the classical languages was a source of contention between American and European Jesuits. Americans in the Jesuit community in California argued for trying to bring up the standards without alienating parents and potential students. Four times as many Santa Clara College students had graduated with a science degree as a classical degree, and Robert Kenna, the college's president during this time, advocated for an adaptation of the classical curriculum to fit the needs of an American education. This would be an education useful to poor, working-class Irish families, whose sons would need only a basic education (one where Latin and Greek were not necessary). However, the European Jesuits, both in California and in Europe, were strongly in favor of reviving the classics. This was even though, or perhaps because, the scientific course had far greater enrollment numbers in comparison to the classical course. At Santa Clara College from 1857 to 1891, the Bachelor of Arts degree, which included the learning of Greek and Latin, was awarded just forty-four times, while the Bachelor of Science degree was conferred 171 times. Nonetheless bowing to pressure from above, in 1887, both Santa Clara College and St. Ignatius College announced that they would only award degrees to students in the classical course who demonstrated proficiency in Greek and Latin. The Bachelor of Science and Master of Science degrees would thus be discontinued.¹⁴⁸ Santa Clara's catalogue had only a cursory

¹⁴⁸McKevitt, *Brokers of Culture*, 276-277; McKevitt, *The University of Santa Clara*, 122-123.

statement of this change: “The degrees will cease with the Class of ’91.”¹⁴⁹

With this pronouncement, enrollment declined at both Santa Clara and St. Ignatius in spite of the best efforts by Kenna and his St. Ignatius counterpart, Henry Imoda. Kenna continued to argue in favor of a scientific course and degree. He provided the Jesuit superior general with examples of the utility of the Bachelor of Science and the lack of a societal need for classical scholars. Kenna cited then president-elect Grover Cleveland as not being even a college graduate and that many of the most successful men were not classical scholars. Within the Santa Clara alumni ranks was U.S. Senator Stephen M. White, whom Kenna touted as “ ‘the most popular man in California’ ” and someone who had earned a Bachelor of Science degree at Santa Clara.¹⁵⁰ Kenna argued that “ ‘had he come later, [Santa Clara College] would not [have given] him a degree.’ White ‘is a power in the land, and there are others like him who cannot and will not come to this college.’ ”¹⁵¹ These pleas fell on deaf ears, however. In San Francisco, Imoda tried to boost enrollment by offering the classical course for free. However, not even a free college education could get students to study the classical languages, so four years later his successor dropped this idea while still being unable to offer the non-classical degree. Inevitably, enrollment continued to decline at both institutions.¹⁵²

¹⁴⁹Santa Clara College, *Descriptive Catalogue of Santa Clara College, Santa Clara, Cal., Session 1887-88* (N.p.: College Steam Print, 1888), 10, Catalogue of Santa Clara College, 1887-1888 to 1892-1893 A&B, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

¹⁵⁰McKevitt, *Brokers of Culture*, 278.

¹⁵¹Ibid.

¹⁵²Ibid., 277-278. In 1913, the Bachelor of Science degree was finally reinstated at St. Ignatius College. Ibid., 384.

The positive outcome of the mandatory study of ancient languages was the overall improvement in the quality of the education. At Santa Clara, an extra year was added to the study of science, philosophy, and literature to earn the new bachelor's degree so that this degree had the same number of courses as the old master's.¹⁵³ Also, the examinations for the Bachelor of Arts degree included tests in logic and metaphysics, trigonometry, analytical geometry, physics, chemistry, calculus, and geology, as well as ethics and natural right philosophy. The Master of Arts degree came with an examination in mechanics, analytical chemistry, mineralogy, political economy, and rational philosophy.¹⁵⁴ Thus, even with the elimination of the science degrees, science still had a major role in the curriculum.

While the place of science changed over time, science and applications of science remained crucial at both Santa Clara College and St. Ignatius College during the first decades of the schools and the state of California. Through science, these schools interacted with the political economy by the actions of the professors, administrators, and students. As the state matured, the needs of its populace changed. The Gold Rush defined California's early years, and mining was one of the most important aspects of the initial state economy. Even with a strong scientific component in the Jesuit educational tradition, mining, metallurgy, and assaying were not necessarily aspects of the classical curriculum that defined Jesuit education. Nonetheless, the members of the Society of Jesus that entered California to found and grow Santa Clara College and St. Ignatius College were adaptive and receptive to the needs of California and worked to

¹⁵³McKevitt, *The University of Santa Clara*, 123.

¹⁵⁴Santa Clara College, *Descriptive Catalogue of Santa Clara College, Santa Clara, Cal., Session 1892-93* (N.p.: College Steam Print, 1893), 8, Catalogue of Santa Clara College, 1887-1888 to 1892-1893 A&B, Santa Clara University Library, Archives & Special Collections, Santa Clara, CA.

include these subjects in the curriculum they offered. As the state continued to grow, new areas such as electricity became important, and again the schools responded appropriately to meet the changing political economy.

Coming to the new state, the Jesuits in Santa Clara and San Francisco could draw upon centuries of their own religious practice and educational tradition. This allowed them to have a successful start to the colleges they established. These schools were able to survive through the dedication and adaptability of their leadership, while science and technology remained major facets of the education provided by both institutions. As the schools responded to their communities, the public supported the schools with donations of funds and resources and most importantly by sustained enrollment. Without enough students the schools would not have been able to survive. Likewise, parents would not have sent their sons unless they believed that the schools provided an education that equipped young men for the working environment they would encounter. Santa Clara College and St. Ignatius College offered a curriculum with a strong emphasis on science and technology, through which both schools responded and advanced the political economy of California.

Chapter 3

Science and Medicine: The University of the Pacific and the Toland Medical College

Introduction

As California became a state in 1850 on the heels of the Gold Rush, the state was in need of building its infrastructure. Individuals and institutions would step in to furnish necessary components. Educational and medical institutions were two of the organizations needed in a well-functioning society. Both of these would be provided, in part, by the founding of the University of the Pacific, one of the first two colleges in California. Established in 1851 in Santa Clara, the University of the Pacific was a Methodist higher educational institution that provided an education for both males and females. As described in the previous chapter, Santa Clara was also the location for another college founded in 1851—Santa Clara College, which was founded by Jesuits. These two colleges played an important role in the development of California.

Although the University of the Pacific could not fully compete with Santa Clara College in terms of science faculty expertise and quality and quantity of scientific equipment, the University of the Pacific did include science with museum collections and a science curriculum and was even more notable in other ways. First, it opened its doors to both sexes, unlike at Santa Clara College, and even allowed its female students to study much of the same curriculum as that of the male students. Second, and perhaps more importantly, within its first decade, the University of the Pacific had claim to the first medical school in California.

Through the establishment of the first medical school in the state, doctors were trained in the state, thus allowing residents of the growing cities of California as well as rural and mining communities to have better access to healthcare. The University of the Pacific's medical

department was soon joined by another medical school—the Toland Medical College. From these two medical schools developed the medical infrastructure of California.

Both the University of the Pacific’s medical department and the Toland Medical College were located in San Francisco and founded in the late 1850s and early 1860s. As the state’s biggest city, San Francisco had the population to support the hospitals and enough patients to enable a medical school to survive. San Francisco was also a key site for treating miners as it was an obvious location for them to come for medical care. This made San Francisco an ideal place to help train future doctors as they learned how to care for conditions that were seen as peculiar to the West Coast of the United States.

The trajectories of the medical department of the University of the Pacific and the Toland Medical College intertwined and at times seemed to meander. While neither survived in their original form to the present day, both contributed to the growth of California’s medical education and healthcare through the work that their early leaders did in establishing medical education in the state both through classroom instruction and the establishment and support of medical journals and societies. Later in their histories, the University of the Pacific’s medical department joined a different college before becoming an independent school and eventually forming the medical school for Stanford University, while the Toland Medical College was absorbed into the University of California.

Although this chapter’s starting point is the early history of the University of the Pacific, I will tell the story of the Toland Medical College to better and more fully relate how medical education developed in California. I will also examine the general science education that was conducted in Santa Clara at the University of the Pacific’s main campus. The University of the Pacific adapted to the needs of the state through its general curriculum by offering a bachelor of

science degree and education in subjects related to mining in addition to allowing women to get an education alongside men. Through the University of the Pacific's general education as well as its and the Toland Medical College's medical education, these two institutions contributed to the political economy of California.

Methodists and Education

The University of the Pacific was a Methodist institution, and as such it developed within the historical tradition of Methodist education. The Methodist educational tradition traces its roots back to its founder, John Wesley, who sought to infuse education with Christian faith and have a Christian education be more than just religious instruction. Wesley believed that education should be used to cultivate mental, moral, and religious accomplishments as education would aid in proper reasoning and rational thinking.¹ For him, education was to be a helper for religion.

The first Methodist college, Cokesbury College, was founded in the United States in Abingdon, Maryland, with classes starting in 1787. While this school only lasted until 1796, in the 1830s two more Methodist colleges were established—Randolph-Macon College in Virginia in 1830 and Wesleyan University in Connecticut in 1831.² Twenty years later, the University of

¹Henry D. Rack, "John Wesley, 1703-91," in *Fifty Major Thinkers on Education: From Confucius to Dewey*, ed. Joy A. Palmer (London: Routledge, 2001), 50-52. A more in-depth examination of John Wesley and his educational beliefs as well as his work with Kingswood School can be found in Alfred H. Body, *John Wesley and Education* (London: Epworth Press, 1936). Wesley lived from 1703-1791 and was a graduate of Christ Church College, Oxford University.

²John O. Gross, *Methodist Beginnings in Higher Education* (Nashville, TN: Division of Educational Institutions, Board of Education, The Methodist Church, 1959) 12-13, 27-28, 38. The first Methodist school, the preparatory Kingswood School in England, was founded by Wesley in 1748. See H. F. Mathews, *Methodism and the Education of the People, 1791-1851* (London: Epworth Press, 1949), 22-24.

the Pacific would be founded by Methodists in the new state of California.

Older denominations had established colleges in the United States well before the Methodists had even begun as a denomination. Nonetheless, in spite of this late start, the Methodists were able to catch up in terms of higher educational institutions with thirty-four such colleges across the country, in nineteen of the thirty-four states, before the Civil War. Beyond its educational late start, the Methodist church had also initially relied on lay ministers and did not see the need for trained clergy. Thus, it was not necessary to have sites to train ministers as was the case for other denominations, whose colleges generally had begun as seminaries. Following the Second Great Awakening, membership in the Methodist Church increased rapidly, particularly with the lower classes in the East and across all classes on the Western frontier. With this quick rise in membership, the church first turned to lay preachers before seeking ministers with a greater educational background beginning in the 1830s. This spurred the denomination to plant colleges across the country.³ Even while many of these colleges were initially founded to train ministers, colleges, like the University of the Pacific, quickly adapted to the local political economy in order to survive and best meet the needs of the surrounding population.

Founding of the University of the Pacific

As California's population grew even before statehood, missionaries of various denominations from the eastern United States came to California to establish churches. Among the denominations were the Methodists, who were also one of the first religious groups that

³Donald G. Tewksbury, *The Founding of American Colleges and Universities Before the Civil War: With Particular Reference to the Religious Influences Bearing Upon the College Movement* (New York: Bureau of Publication, Teachers College, Columbia University, 1932; repr., New York: AMS Press, 1972), 103-111.

entered into the realm of California higher education. California historian Kevin Starr notes that the Methodists' system of preaching was readily adapted to frontier life with lay preachers helping the ordained ministers.⁴ The Methodists joined other religious groups, such as the Jesuits and Congregationalists, that were entering the West and, in particular, California.

Isaac Owen was one such Methodist who entered California, where he helped found one of the first higher education institutions in California. Owen grew up on the Indiana frontier, where he taught himself Greek in order to read the New Testament. Years later in 1849, he traveled overland to California and helped establish the Methodist Book Depository in San Francisco before pastoring in San Jose.⁵ He had been interested in starting a college since he arrived in California, but, according to a colleague of Owen's, he had to wait until there were enough students to support it. The colleague stated (with perhaps only some hyperbole) that the entire state did not have enough children to support one schoolmarm.⁶ The push for a school increased with an 1850 letter to Owen, from Methodist Episcopal Church Secretary Durbin, who suggested an institution of higher learning be established in California. On September 4, 1850, the Methodist California and Oregon Mission Conference appointed Isaac Owen to be the presiding elder in California and the Reverend Edward Bannister to be in charge of an institution of higher learning.⁷

⁴Kevin Starr, *Americans and the California Dream, 1850-1915* (New York: Oxford University Press, 1973), 77.

⁵Ibid., 78.

⁶William Taylor, *Story of My Life*, (N.p.: n.p., 1896), quoted in William Warren Ferrier, *Ninety Years of Education in California, 1846-1936: A Presentation of Educational Movements and their Outcome in Education Today* (Berkeley, CA: Sather Gate Book Shop, 1937), 188.

⁷William Warren Ferrier, *Ninety Years of Education in California, 1846-1936: A Presentation of Educational Movements and their Outcome in Education Today* (Berkeley, CA: Sather Gate Book Shop, 1937), 187.

Owen and Bannister were instrumental in the founding of such a higher education institution through the administration and the procurement of funds for the school. On January 6, 1851, a few months after Owen and Bannister had been appointed to their posts, Methodist ministers and laymen met in San Jose and began work to establish a college, which became the first in California to receive a state charter under the state legislature's act of April 20, 1850. The California Supreme Court issued the charter for the college after finding that the school had a cash subscription of \$27,500 with affidavits affirming the subscribers had enough money for the amount each had pledged.⁸ In total, thirty-eight individuals pledged \$500 or \$1000 to the institution in order for the Supreme Court to issue the charter.⁹ Although classes did not start in 1851, the fact that more than three dozen individuals committed a sizeable amount of money just one year after statehood shows the level of investment of money and energy into this educational endeavor. This was especially true considering that it would be several years before collegiate-level classes were offered and about seven years before the first students graduated with a bachelor's degree.

This first higher educational institution to receive a charter in California did so on July 10, 1851, as California Wesleyan College; the name was changed to the University of the Pacific on August 15, 1851, at the first meeting of the board of trustees. While instruction began in San Jose in September 1851, the school soon moved to Santa Clara with the completion of buildings

⁸Nathaniel Bennett, *Reports of Cases Argued and Determined in the Supreme Court of the State of California* (San Francisco: Marvin & Hitchcock, 1851), 447-448, UOP Archives College History–History of individual decades, years, events, etc., Box 11.1.1.2.1, Folder Calif. Supreme Court acceptance of “California Wesleyan College” charter application (1851), Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

⁹University of the Pacific Charter application, UOP Archives College History–History of individual decades, years, events, etc., Box 11.1.1.2.1, Folder UOP charter 7-10-1851, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

in March 1852. Also on March 29, 1852, a new charter was issued reflecting the change in the school's name. Bannister, who was the principal of the school until 1854, was one of the first presidents of the University of the Pacific, serving from 1859 to 1867. He had been a graduate of Wesleyan University in Middletown, Connecticut, and had been a professor in New York before coming to California.¹⁰ While initially classes at the University of the Pacific were only in the preparatory department, within a few years a college curriculum was offered. This led to the first conferral of baccalaureate degrees on June 9, 1858.¹¹

Besides receiving the first state charter for a college in California, the University of the Pacific was also the first in other areas and demonstrated a level of progressiveness. This occurred primarily through two types of education—that of women and of doctors. The University of the Pacific not only educated boys and young men in its “preparatory” and “male” departments, it also had a “female department” for the education of young women. While these three departments were located in Santa Clara, the education of future doctors in a medical department took place in San Francisco.

Science at the University of the Pacific

The University of the Pacific included science in its curriculum and had a scientific course of study from its earliest years, earlier than the other higher education institution in Santa Clara, Santa Clara College. The *Catalogue of the University of the Pacific, for the Academical*

¹⁰Ferrier, 187-189.

¹¹Kara Pratt Brewer, *“Pioneer or Perish”: A History of the University of the Pacific during the Administration of Dr. Robert E. Burns, 1946-1971* (Fresno, CA: Pioneer Publishing Company, 1977), 8. As described in the previous chapter, Santa Clara College was the first California higher education institution to commence instruction and award the first bachelor's degree.

Year 1856-57, the earliest year available, listed the classes required for each year of study. During the freshman year, the mathematics and science classes included algebra, geometry, and anatomy and physiology. The sophomore year saw students taking classes in trigonometry and mensuration, surveying and navigation, chemistry, analytical geometry, zoology, and botany. Mechanics; shades, shadows, and perspective; calculus; logic; and natural philosophy were the science and mathematics courses for the junior year. Students in the senior year took classes in astronomy, geology and mineralogy, moral science, and physical geography.¹² These courses show the breadth of scientific subjects covered at the University of the Pacific.

Besides the classes taught in the “male department,” other mathematics and science classes were offered in the “preparatory department” and the “female department.”¹³ In the preparatory department, some of the classes taught included arithmetic, elementary algebra, and “familiar science.”¹⁴ In the female department, the applicants had to be familiar with arithmetic, among other subjects, to be admitted. Once admitted, the young women studied the expected course of domestic economy. However, what might seem unexpected to be taught in a female department in the 1850s were many of the other courses of study. These included analysis, arithmetic, elementary algebra, physiology, botany, natural philosophy, algebra, natural history, mental philosophy, chemistry, geometry, mineralogy and geology, moral science, logic, plane

¹²University of the Pacific, *Catalogue of the University of the Pacific, for the Academical Year 1856-57* (San Francisco: Whitton, Towne & Co’s Excelsior Steam Presses, 1857), 8-9, University Catalogs, 1856-1890, Box 11.2.1, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

¹³University of the Pacific 1856-57 *Catalogue*, 14, noted that “Although the two departments of this institution, viz: the Male and Female, are under the same Board of Trustees, yet they are entirely independent of each other in government and instruction.”

¹⁴*Ibid.*, 8.

trigonometry, mensuration, and astronomy.¹⁵ Many of these classes used the same textbooks that were used in the male department. Additionally, and also perhaps somewhat surprisingly, was that the women were not limited to this “basic” course of study but could continue their studies beyond these classes. The *Catalogue* stated that women “who desire to lengthen the course by the study of the Latin and Greek Classics and the higher Mathematics, will be furnished with the requisite facilities.”¹⁶ Thus, from very early on in the University of the Pacific’s history, both men and women had access to very similar courses and an engagement with science.

In the 1860-61 academic year catalogue, a section on “Lectures” was added that listed lectures and field work in scientific areas. The catalogue noted that lectures and experiments would be used to illustrate the principles of chemistry and natural philosophy, while natural history courses were aided through the use of specimens. Additionally, students in surveying courses were trained in field exercises, which allowed them to become competent in the use of such tools as the sextant and theodolite.¹⁷ By this year, the faculty giving such lectures all had a master of arts.¹⁸ In prior years, some faculty that taught mathematics and science classes had only a bachelor of arts or a bachelor of science.¹⁹

¹⁵Ibid., 13-14.

¹⁶Ibid., 14.

¹⁷University of the Pacific, *Catalogue of the University of the Pacific, Santa Clara, California, 1860-61* (San Francisco: Towne & Bacon, Printers, Excelsior Book and Job Office, 1861), 12, University Catalogs, 1856-1890, Box 11.2.1, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

¹⁸Ibid., 3. Most were also ministers, with the title “Rev.” listed in front of their names.

¹⁹For instance, page 3 of the 1856-57 *Catalogue* lists the professor of mathematics and natural science as having an A.B. without the title of “Reverend.” Page 3 of the 1859-60 *Catalogue* lists the professor of natural science as being a reverend and having an A.M., while the professor of mathematics is also listed as a reverend but has a B.S.

At least two years before Santa Clara College had its own scientific course, the University of the Pacific was offering a scientific course of study and a bachelor of science in addition to a bachelor of arts. Both of these degrees and the corresponding courses were offered in the “male department.” The different requirements were described in the catalogue, with the study of “Ancient Languages” being necessary for students to complete “the full Collegiate Course.” Similar to Santa Clara College’s “classical course,” students taking the “collegiate course” at the University of the Pacific received a bachelor of arts. These students had studied Greek and Latin as well as the other subjects, while the bachelor of science did not require the classical languages. Tuition was the other difference between the two courses at the University of the Pacific. While the scientific course cost \$30.00 for the year, the collegiate course cost \$40.00.²⁰

As one example of the relation of education to the political economy, by the 1860-61 academic year the University of the Pacific’s catalogue listed the author of the mineralogy class textbook as “Dana.”²¹ Historian Clark Spence notes that one of James Dwight Dana’s books, *Manual of Geology*, was a basic text for prospective mining engineers.²² For those wishing to enter the mining field, the University of the Pacific met the needs of those individuals through the textbooks and materials the school used. As the mining field was of great importance to the development of California, the University of the Pacific was responding to this aspect of the political economy by providing an education that furthered the state’s growth.

²⁰University of the Pacific 1856-57 *Catalogue*, 10, 15.

²¹University of the Pacific 1860-61 *Catalogue*, 11.

²²Spence, Clark C. *Mining Engineers & the American West: The Lace-Boot Brigade, 1849-1933*, Yale Western Americana Series, 22 (New Haven, CT: Yale University Press, 1970), 39.

Courses related to mining were not the only connection that the University of the Pacific had to this economic sector. The school was also financially invested in the mining industry. When this connection with mining began is not known, but by at least 1866 the University of the Pacific board was actively buying and selling mines to further the financial standing of the institution. In the September 15, 1866, meeting, the board of trustees received a communication on mines and the school's interests from R. M. Widney, who taught natural science at the University of the Pacific. A couple months later on November 28, the board voted to have Widney be the school's agent to exam and purchase mines in Nevada and another individual, Benjamin Day, to sell mines. The following March, the board again took up the subject of mines and how the purchase and sale of mines could benefit the university. Widney spoke at some length about mines, and the board voted to appoint another agent to sell mines on behalf of the school in the eastern states.²³ Clearly, the leadership of the University of the Pacific believed that mining was an important industry, both educationally and financially, to benefit the institution. While evidence is not readily forthcoming regarding the continued financial involvement with mining, for at least some time in the mid-1860s, mining was viewed as a growth industry by the leadership of the University of the Pacific.

In regard to the scientific equipment found at the college, the University of the Pacific's printed descriptions of the equipment were far briefer than the rather detailed listings that were found in Santa Clara College's prospectuses. In order to obtain the scientific equipment for the University of the Pacific, at the 1853 Methodist California Conference meeting, Bannister was

²³University of the Pacific Board of Trustees, *Volume II: Minutes of Board of Trustees 1854-1884*, 288, 296, 302-303, UOP Archives History Trustees Minute Books, 1854-1902, Box 11.4.5.1, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

asked to raise at least a thousand dollars to buy chemical and scientific equipment, while conference members were asked to provide items for a natural history cabinet.²⁴ With these initial efforts, a single sentence in the 1856-57 *Catalogue* summed up the results: “The University has been to considerable expense to provide a suitable Philosophical Apparatus.”²⁵ In the 1859-60 *Catalogue*, the description was still a single sentence but now with the purpose of the equipment: “The University is provided with Apparatus, for illustrating the principles of Chemistry and Natural Philosophy.”²⁶ The following year’s description added astronomy to the principles to be illustrated with the apparatus.²⁷ Additionally, the school now had a “cabinet,” with this section stating that “[a] good beginning has been made in the collection of minerals and geological specimens, and of illustrations in Zoology. These collections are constantly increasing in number and variety.”²⁸ Though it does not appear that the Methodists at the University of the Pacific imported equipment like the Jesuits at Santa Clara College, the University of the Pacific did have a collection of equipment and specimens that was brought about with the assistance of the local community.

By the later 1870s, science was definitely recognized as having importance in higher education and at the University of the Pacific in particular. In two addresses given in 1878 on the occasion of installation of C. C. Stratton as the institution’s president, both Stratton and Annis

²⁴Ferrier, 189.

²⁵University of the Pacific 1856-57 *Catalogue*, 16.

²⁶University of the Pacific, *Catalogue of the University of the Pacific, Santa Clara, California, 1859-’60* (San Francisco: Towne & Bacon, Book, Card and Fancy Job Printers, 1860), 12, University Catalogs, 1856-1890, Box 11.2.1, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

²⁷University of the Pacific 1860-61 *Catalogue*, 14.

²⁸Ibid.

Merrill, board president, spoke on the role of the university and the place of science. Merrill highlighted this connection when he stated that universities with “advantages in every department of learning” needed to “share largely in the affections of the people and the contributions of private generosity.”²⁹ This, he argued, could be done at least in part because these institutions of higher learning have been and are great scientific laboratories “where learning is wrought out; where facts and principles are simplified, and adapted to the comprehension of the tender mind; where the elements of philosophy are investigated and classified; where the astronomer sets down the heavenly bodies in their order, and calculates their sizes, distances, weights, motions and orbits; and all the varied branches of human pursuits.”³⁰ For Merrill, science was a critical part of higher education.

Stratton’s “Inaugural Address” discussed the value of education, especially Christian education. He stated that the “pursuit of science” could answer important questions, while the “pursuit of Latin and Greek has consumed more time in the past than should be accorded” in the present.³¹ He also addressed scientific issues in Christian higher education as well as science and religion. In general, Stratton emphasized the usefulness of science in its applications to

²⁹Annis Merrill, “Charge,” *Addresses, Delivered on Installation of Rev. C. C. Stratton as President of The University of the Pacific, June 5th, 1878, Also Bacca-laureate Sermon, Delivered Sunday, June 2, 1878, By Prof. A. J. Nelson* (San Francisco: Joseph Winterburn & Co., Printers and Electrotypers, 1878), 9, Presidents Papers, 19th C.-1913, Box 1.2.1.1, Folder C. C. Stratton - Corresp. (1885), Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

³⁰*Ibid.*

³¹C. C. Stratton, “Inaugural Address,” *Addresses, Delivered on Installation of Rev. C. C. Stratton as President of The University of the Pacific, June 5th, 1878, Also Bacca-laureate Sermon, Delivered Sunday, June 2, 1878, By Prof. A. J. Nelson* (San Francisco: Joseph Winterburn & Co., Printers and Electrotypers, 1878), 21-22, Presidents Papers, 19th C.-1913, Box 1.2.1.1, Folder C. C. Stratton - Corresp. (1885), Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

California and to society's general education of society. One application of science that the University of the Pacific had already been a part of by the time of Stratton's address was that of medicine, and medicine was definitely useful to California.

Medical Education in the United States

By the time the first medical school in California was established, medical education in the United States had gone through a number of changes.³² In colonial America, those wanting a medical education had three choices available to them: They could study in a European medical school or hospital, apprentice with a physician that trained students, or learn medicine in a more informal way. Studying in Europe was an option only for the wealthy, and early on many physicians chose the informal method to learn the profession. As the eighteenth century continued, the apprenticeship system became the primary alternative for those entering medicine. The first formal medical schools in colonial America began at what is now Columbia University and at the University of Pennsylvania in the late 1760s and at Harvard University in the 1780s. Not unlike what would be seen with the University of the Pacific's medical department, these first medical schools were not "true" academic departments but rather medical schools that needed the colleges in order to award degrees. The colleges were rather welcoming of this arrangement, since without additional costs they were able to broaden their offerings, which had early on often consisted of clergy education. Medical schools began to increase as the public appreciated doctors with medical degrees (first doctors received a Bachelor of Medicine degree

³²Two books that provide useful overviews of the development of medical education in the United States are the following: John Duffy, *From Humors to Medical Science: A History of American Medicine*, 2nd ed. (Urbana: University of Illinois Press, 1993); and Martin Kaufman, *American Medical Education: The Formative Years, 1765-1910* (Westport, CT: Greenwood Press, 1976).

and then after the Revolutionary War a Doctor of Medicine degree). Physicians liked teaching in medical schools as it increased their prestige and helped them gain new patients. The number of schools increased from two in 1770 to four in 1800 and a total of thirteen by 1820. The schools' curriculum was driven by both students and faculty, as students desired anatomy, dissection, and clinical courses, and faculty believed theoretical courses needed to be taught. Few other factors affected how medical schools were run with a medical profession that was unorganized and state and local governments that supported whatever decisions the faculty made.³³

As the nineteenth century continued, medicine in the United States continued to lack unity and any sort of collective authority over doctors, especially in the first half of the century. Not until toward the end of the 1800s did medicine become more cohesive and professional, which was supported by the increased growth of medical schools and the beginnings of medical societies and medical journals. More trained doctors were also needed as individuals increasingly turned to medical doctors rather than home remedies for cures.³⁴ While only thirteen in 1820, by 1860 the number of medical schools had increased to forty-seven. The number of graduates also increased significantly going from 4,338 to 16,717 in the same period. One of the biggest issues that medical schools faced in this period was students wanting better clinical training. Some medical schools were associated with or even built hospitals and dispensaries, and some medical schools also added anatomy and pathology museums. However, these changes did not satisfy all medical students, and some chose instead to get a medical education outside of

³³William G. Rothstein, *American Medical Schools and the Practice of Medicine: A History* (New York: Oxford University Press, 1987), 25, 29-31, 35-36.

³⁴Paul Starr, *The Social Transformation of American Medicine* (New York: Basic Books, 1982), 17-18, 60-61.

a medical school through either an apprenticeship, private courses, or training in hospitals and dispensaries.³⁵ Students may have had ample justification for looking for medical education elsewhere. In the mid-nineteenth century, many of the medical schools operated independently of established colleges and universities, and even when they were part of a larger institution this arrangement was without true oversight by the affiliated college or university. Additionally, medical school faculty often shared in the profits of students' tuition, thus incentivizing faculty to increase the numbers of students perhaps at the expense of more rigorous standards.³⁶

The medical profession in the nineteenth century was challenged by doctors' ability to work with each other. Divisions and feuds between doctors were often bitter, and this hatred could be of a personal nature and out in the open. Medical schools, with a concentration of doctors, were often rife with such problems. Faculty of one school might despise the faculty of another school, and faculty within a school might engage in splits and rebellions.³⁷ California's first medical schools faced these same issues.

In the western United States, including California, several factors led to the establishment and growth of medical schools. Western expansion and a rapidly increasing population created a demand for physicians even before medical schools could be founded to train them. Individualism and self-reliance which characterized many of the individuals that settled in the West also aided in the development of medical schools. Finally, with little—if any—state control or national accreditation of medical schools and medical practice, medical schools were allowed

³⁵Rothstein, 49, 53-55.

³⁶Kenneth M. Ludmerer, *Learning to Heal: The Development of American Medical Education* (Baltimore, MD: Johns Hopkins University Press, 1985), 14-15. Ludmerer's book deals primarily with medical education following the Civil War.

³⁷Starr, 93.

to develop as they saw fit.³⁸

Medicine at the University of the Pacific

Prior to the establishment of a medical school in California, doctors had been present in the state, which according to the 1860 census had a population of nearly 380,000.³⁹ However, without any medical schools, the state generally had to rely on doctors immigrating to the state. This began to change when medical education in California began with the University of the Pacific, although not in Santa Clara, where the campus was located, but in San Francisco. Beginning with the 1859-60 *Catalogue*, faculty were listed for the medical department located in San Francisco.⁴⁰ While science at the University of the Pacific in Santa Clara generally was not more significant or noteworthy than that being done at nearby Santa Clara College, what was quite notable was the establishment of the first medical school in California as part of the University of the Pacific.⁴¹ This not only substantially broadened the type of education offered by the University of the Pacific, but it also was an important development in the political economy of California. Having locally trained doctors was a crucial step in the furthering of

³⁸William Frederick Norwood, *Medical Education in the United States Before the Civil War* (Philadelphia: University of Philadelphia Press, 1944; repr., New York: Arno Press, 1971), 378-379. Norwood's book also provides an examination of medical schools in different states and regions of the United States leading up to the Civil War.

³⁹Joseph C. G. Kennedy, *Population of the United States in 1860; Compiled from the Original Returns of the Eighth Census, Under the Direction of the Secretary of the Interior* (Washington, DC: Government Printing Office, 1864), 28, <https://archive.org/stream/populationofusin00kennrich>.

⁴⁰University of the Pacific 1859-60 *Catalogue*, 4.

⁴¹As the previous chapter demonstrates, Santa Clara College was likely better known for its science in this period due to its more extensive laboratory equipment and professors who had a greater scientific background and thus could interact more effectively with the California populace, including miners.

California as a developed state with an infrastructure to meet the needs of a widening populace.

Although the medical department did not remain with the University of the Pacific permanently, its founding and development was an early step in the establishment of a healthcare infrastructure for California. The training of doctors supported the state through providing needed medical care, beyond what might have otherwise been available by doctors who had immigrated. Doctors had been present in California from the early years of the Gold Rush, though some had come only in hopes of striking it rich like men of all professions did and not with aspirations of caring for the ill. Thus, training doctors within the state provided a boost to the state's development. With more locally trained medical professionals, individuals throughout the state would have the potential for increased access to medical care, and potential immigrants to California might be more comfortable knowing that there was a burgeoning medical establishment in California's largest city—the arrival point for many of the new arrivals to California.

Although the first medical school in California was part of the University of the Pacific, it was not an initiative of the college but rather of a group of doctors in San Francisco who approached the college's leadership with a proposal. This proposal first came at the September 1858 board meetings. The board considered a proposition of a San Francisco doctor, R. Beverly Cole, who, on behalf of three other doctors, wished to have a medical college under the supervision and control of the University of the Pacific board. A further element of the proposal was that the board would have no financial obligations with regard to the medical school. The board's main duties would be to appoint the members of the faculty and vote to confer the degree of doctor of medicine upon the graduates. Hence, on September 22, 1858, the board voted

to elect the first professors to the new medical department of the University of the Pacific.⁴² The University of the Pacific now gained the benefit of spreading its name in San Francisco and among professionals in California, and the medical school gained the prestige of being associated with one of the first two colleges in California.

In the addresses given to the medical students at the 1859 opening ceremony, various speakers explained the need for a medical school in California and justified its location in San Francisco as well as explicitly stating the mission of the school in connection with California. Jesse T. Peck, a member of the board of trustees who represented the president at the ceremony, spoke of the need and want for a medical school by the state. Recognizing that a new state would take time to develop “the high, social and scholarly advantages of the older states,” he nonetheless argued that the state had demanded “instruction in the art of healing, and resolved to supply it.”⁴³ With the idea for the formation of a medical school at the University of the Pacific, Peck noted that the state gave the idea “official sanction.”⁴⁴

The first professor of medical jurisprudence, and also a lawyer, George Barstow articulated the medical school’s mission and its linkage with California. He declared that medical students and doctors “should be ready to appreciate and embrace every new discovery in

⁴²University of the Pacific Board of Trustees, 120, 124-125. These were the September 16 and September 22, 1858, board meetings.

⁴³Jesse T. Peck, “Reply by the Rev. Jesse T. Peck, D. D., in Behalf of the Board of Trustees,” in *Introductory Address Delivered at the Opening of the Medical Department of the University of the Pacific at San Francisco, California, May 5th, 1859 and Addresses by Rev. Dr. Peck and Rev. Mr. Cutler* (San Francisco: Towne & Bacon, 1859), 6, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder Carman & Barstow Addresses; Opening Addresses by Peck & Cutler; 1859, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

⁴⁴Ibid.

science,” this being a qualification “which California demand[ed] in her medical men.”⁴⁵

Barstow argued that it was the right time for the state to have institutions where doctors could be trained, and, speaking directly concerning the political economy of the state, “time for this State to be multiplying steadily her own resources; to be purifying and strengthening her own social structure.”⁴⁶ He went on to stress that with California being a new state “came a demand for knowledge and skill.”⁴⁷ In addition, this demand for medical education needed to be done in California, he and his medical colleagues believed, because of the “peculiarities of [the] climate, the new and peculiar forms of disease, and the new conditions under which the human body is found to exist and to act here.”⁴⁸ He further stressed that California was no ordinary new state but one in which a mature civilization was transplanted to the Pacific Coast and thus should have the same sort of institutions as found on the Atlantic Coast.⁴⁹

Barstow saw universal education beginning with common schools and extending to medical schools as vital to “public health and public wealth.”⁵⁰ He also argued that building and

⁴⁵George Barstow, “Introductory Address by the Hon. George Barstow,” in *Introductory Address Delivered at the Opening of the Medical Department of the University of the Pacific at San Francisco, California, May 5th, 1859 and Addresses by Rev. Dr. Peck and Rev. Mr. Cutler* (San Francisco: Towne & Bacon, 1859), 9, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder Carman & Barstow Addresses; Opening Addresses by Peck & Cutler; 1859, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

⁴⁶Ibid.

⁴⁷Ibid., 13.

⁴⁸Ibid., 14.

⁴⁹Ibid.

⁵⁰Ibid., 15. Barstow also made explicit a connection between education—including medical—and a theological belief in God and special creation. For instance, he argued that higher education was a way of opening the mind to allow it to gain an understanding of the Creator’s power and goodness. He compared a medical doctor to a mechanic (of the body) and argued that

maintaining institutions such as schools, colleges, hospitals, libraries, and asylums were important to a government providing “the greatest good to the greatest number” through the “relief of suffering and the diffusion of knowledge.”⁵¹ As one of the founding faculty members of the medical department of the University of the Pacific, Barstow highlighted the role that he, and likely the other professors, believed education should play in the development of the state. Within that education, Barstow put health education and the role of doctors in a preeminent position. California, although a young state, was one he found to have action and adventures—full of life and courage, but also a state in which “health is essential; else the machinery stops.”⁵² Barstow linked the mind and body by noting that without a healthy body the mind would not be able to function properly and carry out tasks.⁵³ Here is one of the clearest indications of how the founders of the first medical school viewed their mission, at least publicly. Through educating doctors and providing healthcare to the citizens of California, these medical school founders put forth the idea that training doctors within California would allow the machinery of the state to continue to function and California as a whole to prosper.

Barstow also indicated why he believed San Francisco was an ideal site for the first medical school. San Francisco was the primary port on the Pacific Coast, and its climate allowed medical work to be conducted all year. Additionally, the faculty physicians had large patient practices and were thus well acquainted with the diseases and treatments particular to California.

the mechanisms of the eye, ear, hand, and foot lead the mechanic, or the doctor, to the conclusion that there is a more skillful “mechanic,” that being God, as the originator of these.

⁵¹Ibid., 16.

⁵²Ibid., 17.

⁵³Ibid.

Finally, he argued that California had given its people “mineral treasures,” undoubtedly speaking of gold, and it was the duty of the California people to repay this debt, such as through the development of educational institutions.⁵⁴ Thus, Barstow’s address at the opening of the medical department of the University of the Pacific distinctly laid out the rationale behind establishing such a school and the benefit that its founders saw it could provide to the state. Clearly, the men in the medical department wanted to emphasize that the welfare of California was on their minds.

The Rev. Mr. Cutler⁵⁵ followed Barstow’s address by continuing to highlight the role of the medical school in the development of California. He spoke of a new society being created in California and institutions of learning as “among the first elements of civilization” in the state with every “school-house, . . . college, . . . church and . . . temple of justice . . . a pledge and security for future good.”⁵⁶ Beyond the general ways in which educational institutions helped create a better society, Cutler also noted that a medical institution, in particular, was vital for society through the science that doctors brought to the treatment of ailments. He stated that the sick had no patience with quackery but that doctors had to learn all about “the animal, vegetable, and mineral kingdom” as well as knowing “the laws of . . . activity and health” and “the curative

⁵⁴Ibid., 15, 18.

⁵⁵Unfortunately, I have not been able to locate any other information on who Cutler was.

⁵⁶Cutler, “Address by Rev. Mr. Cutler,” in *Introductory Address Delivered at the Opening of the Medical Department of the University of the Pacific at San Francisco, California, May 5th, 1859 and Addresses by Rev. Dr. Peck and Rev. Mr. Cutler* (San Francisco: Towne & Bacon, 1859), 19, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder Carman & Barstow Addresses; Opening Addresses by Peck & Cutler; 1859, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

properties of plants and minerals.”⁵⁷ As a layman, he may have been expressing his own personal distaste for “quacks” and hoping that with better trained doctors, the public would gravitate to properly trained medical men. With knowledge as “the *first and essential* requisite in [a] good physician,” a medical school—such as the one being established in San Francisco which would impart such knowledge—should thus “draw . . . the favor and support of the whole Pacific coast.”⁵⁸ Cutler believed that the people of California would indeed support the institution, and, when so supported, it would be able to “promote the advancement of one of the most important and useful of all arts.”⁵⁹ Medical schools, at least in Cutler’s estimation, could provide a key educational development for California and, by extension, the entire western United States.

The medical department formally began on May 5, 1859, with the first session concluding in September. Thirteen students enrolled in the first class, with two of them receiving an M.D. degree after having attended other medical schools previously. This led the board to note that the first course of lectures had finished “under auspicious circumstances” and that the department was in “a flourishing condition.”⁶⁰ Although the board had little to do with the actual operation of the medical department, instead leaving that to R. Beverly Cole as dean and to the other medical professors, the board did take their oversight seriously. They had regular updates from Cole and also had some of the board meetings in the buildings housing the medical

⁵⁷Ibid.

⁵⁸Ibid., 20 (*italics in original*).

⁵⁹Ibid.

⁶⁰University of the Pacific Board of Trustees, 136, 145. The June 7, 1859, meeting recorded the opening of the medical department, and the September 16, 1859, meeting discussed the end of the first session.

department in San Francisco.⁶¹

A few months after the speeches given at the opening of the medical school, the first commencement was held on September 13, 1859. Benjamin Carman, the professor of materia medica or what is now generally called pharmacology, was chosen to deliver the valedictory address. Looking back over the first months of the medical department's existence, Carman celebrated the successful completion of the medical school's first session. Carman pointed out that the University of the Pacific's standards had not been compromised in graduating two individuals after such a short time as the men had come from other medical schools with high recommendations and so had subsequently fulfilled the University of the Pacific's stated requirements, which Carman declared were as high as those at any other medical school in the country.⁶²

Carman recounted the establishment of the University of the Pacific as first only needing a literary department but as the state grew and the students matured throughout California's first decade, a demand for further areas of study was met with the creation of the medical department. He stated that the first medical schools in America were begun to better study the specific diseases and conditions found there rather than relying on information from Europe, and so, he argued, the same should hold true for establishing a medical school in the new state of California

⁶¹Ibid., 231. One example of this is from the March 12, 1863, meeting of the board, which specifically mentioned meeting in the medical department buildings, while several other board meetings were held in San Francisco although not necessarily at the location of the medical department.

⁶²Benjamin R. Carman, "Valedictory Address," 1, 6-7, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder Carman & Barstow Addresses; Opening Addresses by Peck & Cutler; 1859, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA. No reason is given for the two new doctors having transferred to the University of the Pacific to finish their medical education.

with its own peculiar diseases and conditions. With this basis, the medical school had been created and had graduated its first two doctors who would now be able to practice medicine based on scientific principles and not popular beliefs.⁶³ As had occurred in May, an audience in San Francisco heard from founders of California's first medical school that they believed this medical school was to be a benefit to the state's citizenry and one that would allow the state to continue to grow and mature.

Supporting this view of the medical school was the *California Farmer and Journal of Useful Sciences*, which in 1860 published an article that praised the creation of a medical school in the state. Noting that until the University of the Pacific's medical department had opened students of medicine had to complete their studies in the "far distant East," which required a "trip fraught with danger and expense."⁶⁴ In spite of California being isolated from the rest of the nation, "the spirit of American enterprise [had] not been dormant in establishing not only theological, [and] literary, but medical institutions."⁶⁵ Similar to Carman's assertion of the quality of the education at the University of the Pacific, the article stated that a "thorough medical education" could now be obtained in California that was "equal to another other State in the Union."⁶⁶ While there is no way of verifying how equal the medical education actually was to other medical schools, having a medical school in California was at least a source of pride for this publication.

⁶³Ibid., 2-5, 10.

⁶⁴"Medical Education on the Pacific Coast," *California Farmer and Journal of Useful Sciences* (San Francisco), April 5, 1860, 60, <https://cdnc.ucr.edu>.

⁶⁵Ibid.

⁶⁶Ibid.

About three years later, another of the founding doctors, Henry Gibbons, was called upon to give the commencement speech. While his address was mostly about the role of doctors and the role of science in medicine, he also noted how doctors and medicine in California responded to the state's specific conditions. With regards to medicine, he believed that botany was an important area of instruction as the plants of California needed to be studied to find out what medicinal properties they might contain, not to mention the enjoyment that one could have from examining flowers, especially in rural areas where the many enjoyments of city life were not present. He also contended that doctors in California, more than anywhere else, performed services for free due to the less-than-adequate services for the indigent. Gibbons thought this a worthy use of a physician's time and knowledge, especially if done without calling attention to oneself.⁶⁷ Gibbons' address showed what he believed that graduates of the medical department ought to do to contribute to California. How many of the graduates actually participated in such community service and what his basis for favorably comparing California doctors to the rest of the nation is not known.

Faculty members of the medical school had often stated that one of the main reasons for having a medical school in California was because of the special needs found in the state. While these faculty generally did not elucidate what those needs were, one of the first graduates, C. A. E. Hertel, did in an 1896 letter he wrote to T. H. Sinex, a former president of the University of the Pacific, about the start of the University of the Pacific's medical department. In the letter,

⁶⁷Henry Gibbons, "Valedictory Address Delivered at the Public Commencement of the Medical Department of the University of the Pacific, Held March 15th, 1862," 27-28, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder UOP Med School Bulletin, 1862/63 & Henry Gibbons Valedictory Address, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

Hertel stated that California's medical needs were different due to the unique diseases and accidents found in mining areas and thus required different treatments than found in the eastern United States. This need to treat miners was also one of the reasons why the medical school was located in San Francisco, rather than in Santa Clara where the University of the Pacific was located. Hertel listed six reasons why San Francisco was the best location for the new medical school. These were the climate that allowed dissections to be done in both summer and winter, the materials found in the city, the hospitals San Francisco already had, the faculty already living there, the inhabitants of the city being of a "cosmopolitan" nature, and "especially" the miners coming to San Francisco for treatment.⁶⁸ These reasons were similar to ones that had been given in addresses by faculty members. Hertel also noted the location of San Francisco, directly addressing the political economy by wanting to be present where treatment could be given to a key segment of the workforce—the miners. It certainly did not hurt either that San Francisco, as California's largest city, would have provided the most resources and amenities for the doctors in both their personal and professional lives.

The *Daily Alta* newspaper, in 1862, also argued for having a medical school in San Francisco. In an editorial primarily discussing the need for a state university, the newspaper wrote that San Francisco should be the location for the proposed university due to medicine likely being one of the most important departments of the future institution. It would only make sense for all departments of the state university to be in the same city, and medicine needed to be

⁶⁸C. A. E. Hertel to T. H. Sinex, February 8, 1894, 2, UOP Archives College History-History of individual decades, years, events, etc., Box 11.1.1.2.1, Folder Hertel Reminiscence 1894, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA. Hertel also gave an explanation why he was able to graduate after just one year of study in the medical department of the University of the Pacific. This had been due to him taking a full course of study at a medical school in New York. *Ibid.*, 4.

in San Francisco as it would provide what the students needed from a medical department.⁶⁹ About a decade later, the *Daily Alta* again addressed San Francisco as a prime location for having a medical school. By now the University of California had been established, though not in San Francisco, but that city still had many reasons for having a medical school. One reason the paper presented was that California's climate would attract "invalids," who, while perhaps preferring valleys away from the ocean or the drier climate of the southern part of the state, would come to the city for the doctors and "pleasures of city life."⁷⁰ Another reason was that San Francisco, by its size and location, had difficult cases that students could learn from. Such cases might include individuals who had illnesses or injuries from long sea voyages, the mines, or "wild adventures of the frontiers."⁷¹ Like Hertel, the newspaper saw San Francisco as the location where a medical school could provide a great benefit and where medical students could gain valuable experience. The fact that the newspaper was based in San Francisco may have also contributed to the strong sentiment toward the city, but the size and location of San Francisco certainly had some advantages over smaller cities in California.

Toland Medical College

Within a few years of the founding of the University of the Pacific's medical department, a second medical school was also started in San Francisco. This school, the Toland Medical College, was founded by Hugh Hugher Toland, generally known as H. H. Toland. He was born

⁶⁹"The State University of California," *Daily Alta* (San Francisco), February 23, 1862, 2.

⁷⁰"Medical Education in San Francisco," *Daily Alta* (San Francisco), April 9, 1873, 2.

⁷¹*Ibid.*

in the first decade of the 1800s in South Carolina and began studying medicine at age sixteen with a local doctor before entering a medical college in Kentucky two years later. During the Gold Rush, Toland went across the continent in 1852 to try his hand at prospecting. He soon went back to practicing medicine. In San Francisco, he became known for diagnosing and prescribing patients by mail without ever seeing them in person. He ran his own drug store, and in fifteen years he filled 581,000 prescriptions; by 1860, he was making an annual income of \$40,000.⁷² He also became a member of the first board of health in San Francisco, which he served on until his death in 1880. Beyond his medical work with founding the second medical school in California, he also oversaw a medical journal, the *Pacific Medical Journal*.⁷³

As Toland was beginning his medical school, one of the main founders of the medical department of the University of the Pacific died. Besides Cole, Elias Samuel Cooper had been a driving force behind the proposal to the University of the Pacific's board that resulted in the creation of the medical department. Although Cole had been the dean of the medical department, it was Cooper that continued to motivate and recruit faculty, including his nephew, Levi Cooper Lane. When Cooper died, the medical faculty lost the primary individual that had kept them functioning cohesively through their early years.

At the same time, Toland needed more doctors to be professors in his school in order to keep his medical school developing. He thus recruited doctors from the University of the

⁷²Frances Tomlinson Gardner, "The Little Acorn: Hugh Hugher Toland, 1806-1880," 61-65, Reprinted from *Bulletin of the History of Medicine* xxiv, no.1, January-February, 1950, 308z.%647.G225, The Bancroft Library, University of California, Berkeley.

⁷³Alfred Bates, "Toland, Hugh Hugher, 1809-1880 biographical sketch," 1-10, Biographical sketch of Hugh H. Toland, with related material, 1889, BANC MSS C-D 842, Folder 1 "Toland, Hugh Hugher, 1809-1880 biographical sketch" unknown author perhaps Bates, The Bancroft Library, University of California, Berkeley. Toland was also a leader in the state Democratic Party and the owner of a large wheat ranch in the Sacramento Valley.

Pacific's medical department. With Cooper dead, this task was accomplished rather easily, and several of the leading doctors, including Lane, Cole, and Gibbons, all left the University of the Pacific to join the Toland Medical College. Although their reasons for joining Toland remain unclear, arguably Toland's ambitious project and relentless drive (along with his ability to make a profit) must have been a factor in their decision to join the Toland Medical College. However with the primary doctors from the medical department gone and a founder dead, the medical department of the University of the Pacific closed. No mention of the closing was made in the board meeting minutes, and, of course, the catalogues no longer contained any reference to medical education.

The moving of faculty from the University of the Pacific to the Toland Medical College was voluntary, but soon Toland's medical community had dissension. In a move that would seem to give his school more credibility, he made Cole, previously dean of the University of the Pacific's medical school, the dean of the Toland Medical College. In spite of having Cole as dean with his old colleagues, only a few years after the defection from the University of the Pacific, most of those same faculty members returned to the University of the Pacific in 1870 to restart a medical school for that institution. Cole, however, did not make the return trip to the University of the Pacific but instead stayed with Toland.

Although Cole was loyal to Toland and his medical school, this did not mean that Cole was a personal admirer of the man. Years after Toland's death, Cole recounted his views on Toland. Throughout several pages of his recollections, Cole mostly disparaged Toland and his professional ethics. Cole charged Toland with being overly ambitious, unprofessional, and selfish, although Cole did credit Toland with being a fine surgeon and medical doctor in general. Cole stated that while Toland was very successful as a surgeon, he was also unprofessional,

“supremely selfish,” “a man of limited intellectuality,” and “a man of inordinate vanity.”⁷⁴ While other views of Toland existed, none were as strong in their defense of Toland as Cole was in his criticism.

One defense of Toland came from one of his students, who stated that Toland never did anything unethical or against the medical profession and would not even for a fee consult with someone who had enmity with him. This student, who only knew him for the last five years of his life, described his former teacher as a physician who based his decisions on “good judgment” with a “strict regard for the ethics of the profession.”⁷⁵

Toland’s true nature was a complicated and not uncontroversial one. His drive brought about the creation of a second medical school in California. With the medical department of the University of the Pacific refounded and the Toland Medical College continuing to operate under the leadership of Cole and Toland, a rivalry and competition developed between the schools.

Two Medical Schools

With the University of the Pacific again having a medical department, two medical schools now existed in San Francisco. Once the medical department of the University of the Pacific restarted in 1870, the core faculty remained the same throughout the next years in spite of other institutional changes. A few years after the department was reconstituted, the faculty again

⁷⁴Beverly Cole, “Dictation of Dr. R. Beverly Cole, Sep’r 12th regarding Dr. H. H. Toland,” 1, Biographical sketch of Hugh H. Toland, with related material, 1889, BANC MSS C-D 842, Folder 4 “Toland, Hugh Hugher, 1809-1880 dictation of Beverly Cole,” The Bancroft Library, University of California, Berkeley.

⁷⁵Robert A. McLean, “Dictation of Robert A. McLean,” 3-6, Biographical sketch of Hugh H. Toland, with related material, 1889, BANC MSS C-D 842, Folder 5 “Toland, Hugh Hugher, 1809-1880 dictation of Robert A. McLean” Sept. 30, 1889, The Bancroft Library, University of California, Berkeley.

made a change, although this time it appears to have been one that was much more amicable than what had happened with Toland. Due to the distance between the medical department in San Francisco and the main campus of the University of the Pacific in Santa Clara, where the administrators were located and where the board generally met, the faculty of the medical department decided to again leave the University of the Pacific and in 1872 to join another college. This particular college, University City College, was Presbyterian and located in San Francisco. This enabled the medical faculty to derive advantages that would have come with being adjacent to the rest of a college's faculty and overall institutional support. Unlike with the prior move, this change was discussed in the catalogues for the medical department, now called the Medical College of the Pacific. The explanation seemed to be one that made logistical sense, although again no mention of this split was made in the University of the Pacific board minutes.

After a few years as the Medical College of the Pacific under the aegis of University City College, a change was once again made to the first medical school in California. This time it became a completely independent institution. Levi Cooper Lane, during his tenure as one of the longtime faculty members, had also financially prospered as a doctor. With his wealth, he was able to provide the necessary funding to create the independent school. He named it after his uncle, Elias Samuel Cooper, and called it Cooper Medical College.⁷⁶ This latest incarnation continued to exist until the early twentieth century, when the medical school found its permanent home as the medical school of Stanford University.

As for the Toland Medical College, its path was not quite so meandering as its competitor. Soon after the University of California was founded in 1868, Toland began to

⁷⁶Cooper had been one of the primary doctors behind the original establishment of the medical department of the University of the Pacific, and it had been his death that precipitated the faculty moving to the Toland Medical College.

discuss the possibility of incorporating his school into the University of California. One of his main stipulations was that the medical school would still continue to be named after him. However, the Regents of the University of California said that a school would not be named for an individual. Toland and the university president, Daniel Coit Gilman, continued to negotiate on what would be a reasonable compromise. It was finally decided that a building would be named for him instead of the school and a Toland Chair of Surgery would also be created. With this agreement in place, the Toland Medical School became the medical school for the University of California. At this time, the only campus for the state university was located in Berkeley. Eventually, though, the medical school was the forerunner of the University of California, San Francisco—the only campus of the University of California to not have undergraduate students but to focus solely on graduate and professional students in the health sciences. The fate of H. H. Toland’s personal legacy was not as long lasting in the ways he had hoped. He did indeed have a building named after him, but only a few years later the building was torn down. The other part of the agreement—a named chair in surgery—never happened. Nonetheless, H. H. Toland’s legacy did live on through his medical school, which brought medical education into the University of California educational fold.

At the start of the 1870 medical school session, Henry Gibbons recounted the trajectory of medical education in the United States and specifically in California. He described the founding of the first medical associations in California and the subsequent founding of the first

medical school largely as a result of the efforts of Elias Cooper.⁷⁷ According to Gibbons, while San Francisco, and by extension California, did not have a “requirement” for a medical school at the time, the city “would soon demand such an institution.”⁷⁸ Gibbons next described how another medical school was founded, and how the medical school at the University of the Pacific ceased operations. As the primary reason for the closure of the University of the Pacific’s medical department, he cited the faculty not wanting to “engage in a competitive struggle” that would result “in a contest which might involve personal animosities, and injure the character of the profession and lower the standard of medical education and the value of a diploma.”⁷⁹ As Gibbons portrayed it, the University of the Pacific faculty were doing the noble thing by not competing with Toland’s school and instead joining the faculty of the Toland Medical College. However, this arrangement lasted only a few years before the situation warranted another change—the restart of the medical department of the University of the Pacific. Gibbons shed only a little light on the reason this happened by claiming the Toland Medical College had “not accomplished [the University of the Pacific faculty’s] expectations.”⁸⁰ This, along with “additional causes . . . unprofitable to mention,” led to several faculty leaving the Toland Medical College and the “reorganization of the Medical Department of the University of the

⁷⁷Henry Gibbons, “Introductory Lecture to the Eighth Session of the Medical Department of the University of the Pacific, Delivered July 5th, 1870,” 205, Record Groups: School of Elocution, Asian Studies, Female Institute, College Park Academy, UOP Medical School, (Misc. Schools), Box 2.7.1.1, Folder Valedictory Address, Introductory Lecture by H. Gibbons, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA.

⁷⁸Ibid., 6.

⁷⁹Ibid., 7.

⁸⁰Ibid., 8.

Pacific.”⁸¹

Along with the development of the medical schools came the development of medical journals. Each of the schools had a journal associated with it, and these journals would sometimes utilize their editorial pages to discuss the merits of, or more likely the lack thereof, the rival schools. Other journals came and went rather quickly, and often the articles in any of the journals had a medical and scientific value that was fleeting at best. Nonetheless, the journals provided an outlet for the sharing of useful medical information about conditions found in the West.⁸²

One of the journals was the *Pacific Medical and Surgical Journal*, which was edited by Henry Gibbons and his son, Henry Gibbons Jr., and, not unsurprisingly, associated with the University of the Pacific’s medical school. In more than one piece they editorialized about the prospect of the University of California claiming the only power to grant medical degrees by the establishment of an “independent” board of examiners. The University of the Pacific clearly felt threatened as several pages were devoted in the September 1870 issue to this topic and then the November 1870 issue had another paragraph related to the subject under the heading “A Farce, or Something Worse.” The paragraph related that the University of California Regents had indeed appointed examiners with six professors from the Toland Medical College and “not one of the other School!” [the University of the Pacific].⁸³ As the University of the Pacific continued

⁸¹Ibid.

⁸²Henry Harris, *California’s Medical Story* (Springfield, IL: Charles C. Thomas, 1932), 144-149.

⁸³Henry Gibbons and Henry Gibbons Jr., *Pacific Medical and Surgical Journal* (San Francisco: John H. Carmany & Co.), 1871, 176-178, 281, California State Library, California History Section, Sacramento, CA. The journals’ issues were reprinted in one volume.

to operate and graduate future doctors, evidently this matter was cleared up but not without first causing some degree of controversy.

Besides operating a medical journal, doctors from the University of the Pacific participated in professional societies, such as the California State Medical Society. For instance, in 1870 the society's committees included several members of the medical faculty from the University of the Pacific. Henry Gibbons Sr. served on the practical medicine committee and the special committee on pharmacy and quack medicine. His son was on the publication committee, and both father and son were on the indigenous botany committee. Lane was on the surgery and prize essay committees, while Carman participated on the medical education committee.⁸⁴ Having the faculty members serving in these roles no doubt gave them useful material to add to their lectures as well as bringing recognition to the University of the Pacific's medical department through their work with the community and state.

Reorganization and Further Development

After the University of the Pacific's medical department restarted, a reorganization of medical education occurred. Based on recommendations from the Convention of Medical Teachers and the American Medical Association, the medical department extended the length of the medical course of study and added two new chairs in departments related specifically to subjects—including ophthalmology—of “special importance on the Pacific Coast.”⁸⁵ Why ophthalmology was of more importance to California than elsewhere in the country Gibbons did

⁸⁴“State Medical Society,” *Daily Alta* (San Francisco), October 21, 1870, 1.

⁸⁵Gibbons, “Introductory Lecture to the Eighth Session,” 8.

not say in an address outlining some of the changes, but apparently it was one of the subjects that seemed to need extra attention to adequately care for the California population. Beyond adding the new fields, the medical department now contained a “complete and extensive laboratory” used “to illustrate the chemical lectures, and to give [the lectures] that practical application which is essentially demanded by the conditions of life and business on the Pacific Coast.”⁸⁶ Additionally, greater clinical instruction was seen as a necessity to medical education, so the University of the Pacific had arranged for the medical students to gain practical experience at St. Mary’s Hospital. Likewise, pharmaceutical knowledge was also needed, so a dispensary was established. Local pharmacists supplied medications that were then dispensed to the poor, who could also receive medical advice from the medical faculty and students.⁸⁷ With the reconstitution of the medical department, specific attention was given to the needs of California and to the general betterment of medical education.

Having made changes to the medical curriculum as well as with proposals for future improvement, Gibbons saw that it was “probable” that they were “on the eve of a revolution in medical education.”⁸⁸ This was necessary, in his opinion, due to the devaluing of the medical diploma because of the nature of education found in some schools. Thus, four main changes were called for, which were medical students having first obtained at least a basic education in languages and other areas, a lengthening of the term of study with three courses of lectures, having exams at the end of each course, and modifying the courses in order to provide a better fit with the continuing knowledge of the students. The other principal reform that needed to be

⁸⁶Ibid.

⁸⁷Ibid., 9.

⁸⁸Ibid., 10.

made was, according to Gibbons, an independent and impartial body that would confer degrees to remove this privilege from institutions that degraded the degree due to rivalry, professors' favorite students, and the buying of degrees. Gibbons believed that having such a body could be accomplished in the state by having the University of California become an institution that would oversee a board administering exams and conferring degrees.⁸⁹ Although Gibbons' idea did not come to fulfillment, the concept did end up occurring as greater oversight came for accrediting medical schools and uniform, national examinations for the licensure of doctors.

Even two decades after California statehood, Gibbons still found it necessary to argue for parents educating their children in California rather than sending their children to the eastern United States. This was a parallel occurrence to what was happening on the East Coast when parents sent children to Europe for an education. Gibbons' primary argument for educating doctors in California, or in their home locality wherever that might be, was that each area had its unique climate and diseases that required at least the foundation of a medical education to take place where they would practice.⁹⁰

A few years later, Gibbons again gave an address, this time at the 1874 commencement for the medical school, now the Medical College of the Pacific (having transferred its affiliation from the University of the Pacific to University City College), in which he included remarks on the charitable work that doctors did in San Francisco. After providing advice for the new doctors, Gibbons turned to the local conditions found in the city. He stated that it was the duty of

⁸⁹Ibid., 10-11. Ironically, Gibbons made this statement about a year before the journal he edited published the statement mentioned previously that decried the University of California from trying to do something very close to this, albeit without including the University of the Pacific in the process.

⁹⁰Ibid., 12.

doctors to respond to the needs of those suffering and in poverty, even if San Francisco expected this care for its citizens but only compensated doctors with a small percentage of the normal rates they would have earned.⁹¹ This charity work was compounded by the fact that the city had stopped paying for the medical school's dispensary to provide medicines for the poor. While this occurrence caused Gibbons to have his "cheek burn with shame," he nonetheless believed that physicians do not expect to be paid for their services to the poor but accept this as "their duty to humanity."⁹² As a final piece of wisdom for the new doctors, Gibbons urged them to consider the philanthropic aspect of the medical profession and not be selfish. Instead of trying to get financial compensation, physicians caring for the poor should be content with being "rewarded only by the still small voice within—a consciousness of duty performed."⁹³ Thus, in his departing words to his students, Gibbons encouraged them to do good in their community.⁹⁴

⁹¹Henry Gibbons, "Extracts from the Valedictory Charge, of Professor H. Gibbons, Sr., at the Commencement Exercises of the Medical College of the Pacific, held in Calvary Church, Nov. 5, 1874," 4-5, Cooper Medical College, Precursor: Medical College of the Pacific, Catalogs; Valedictory Addresses, 1872-82, MS 94 Box 1, Folder Medical College of the Pacific, University (City) College, SF – Valedictory Addresses, 1872-79; 81-82, Holt-Atherton Department of Special Collections, University of the Pacific Library, Stockton, CA. Gibbons stated that San Francisco made a total compensation of about \$20,000 a year for all the doctors caring for the poor when the same group of doctors would have earned a total of \$500,000 for the same work had they charged normal rates.

⁹²Ibid. In fact, Gibbons claimed, a doctor working for the city had discovered that the city supervisors had no legal authority to pay for the medicine and thus this arrangement had ended forcing the dispensary to provide both the doctor visits and the medicine for free.

⁹³Ibid., 6.

⁹⁴Also in this address, Gibbons highlighted the "extraordinary discoveries and enterprises of Robert Dale Owens, Katie King, and others," who through their work were providing a "prospect of recovering some of that lost treasure." As King was the name of a spirit guide known in this time and Owens also engaged in spiritualism during the same period as Gibbons' speech, it is likely that Gibbons was referring to knowledge that could only be obtained through the spirit world, although he was not explicit in what he was referring to. Ibid., 2.

In the four-and-a-half years since Gibbons gave his introductory address at the 1870 opening of the school year, his concerns—at least as far as his public remarks showed—were less about the state of medical education and more about the state of caring for the poor. Perhaps this was because while the 1870 address was at the start of the school year, this 1874 address was given to graduating doctors. However, it could also have been that in the four-plus years, some of the challenges to medical education that Gibbons had seen earlier had been resolved. Additionally, taking care of those less fortunate would also be an aspect of a maturing state as more basic needs were addressed and other conditions of society were given a focus. No matter the reason for the change in emphasis in Gibbons' addresses, both providing better medical education and increased care for the poor were important facets that Gibbons described in the training of doctors and the work of a medical school.

The early years of medical education in California were full of twists and turns and often colorful. While going through the nuances of these developments is beyond the scope of this study, what is important to recognize is that in spite of doubts of some in the medical community both the University of the Pacific's medical department and the Toland Medical College did survive, albeit as medical schools in different institutions.⁹⁵

The founding of the first medical schools in California had a legacy that extended beyond the immediate treatment of California population by leading to the further development of the state's medical infrastructure through further medical education and medical journals. As might

⁹⁵For an early overview of the history of the institutions (as well as a general history of medical education in California), see *California's Medical Story* by Henry Harris, pages 131-141. In a 1934 review of the book for the journal *Isis*, the reviewer called the narrative "racy." See C. D. Leake, review, *Isis* 22, No. 1 (December 1934), 314, <http://www.jstor.org/stable/225364>.

be expected, things started out slowly, with twenty-eight graduates during the first six years of the University of the Pacific's medical department, from 1859 to 1864. One of those who graduated in 1864 was Henry Gibbons Jr., who would go on to be the long-serving dean of the school throughout its various affiliations.⁹⁶ Among the graduates of the Toland Medical College was Joseph Widney, who graduated in 1866 and went on to be the founder of the medical school at the University of Southern California.⁹⁷ While the University of the Pacific had accepted women in at least its female department from its earliest days, no women graduated from either medical school until the 1870s. No indication is given that medical students had to be men, but it was not until 1873 that the Toland Medical College accepted its first female student and the first female student entered Medical College of the Pacific in 1877.⁹⁸

Conclusion

The University of the Pacific, as described in this chapter, and Santa Clara College, as described in the previous chapter, both did what it took to respond as best they could to the needs of the political economy of California. For both, there was a good deal of self-preservation that was part of the equation in their offerings. With limited numbers of potential students, they needed to make sure that they were offering classes and degrees in an environment that parents would want to send their children to rather than sending them to a school in the eastern United

⁹⁶Harris, 134.

⁹⁷Ibid., 138.

⁹⁸Windsor Cutting, "The First Hundred Years," *Stanford University School of Medicine: The First Hundred Years* (Glendale, CA: Mirro-Graphic Yearbooks, 1959), 4, <https://archive.org/details/StanfordUniversitySchoolOfMedicine-FirstHundredYears>. For comparison, the first woman in the United States to graduate with a medical degree was Elizabeth Blackwell in 1849.

States or perhaps Europe or not to a higher education institution at all. Thus, both Santa Clara College and the University of the Pacific showed that they were responsive to the political economy in their offerings of classes and degrees and through the fact that they survived the first decades of California's statehood. The responsiveness of these first two institutions of higher education in California was the key reason for their long-term survival. They took into account the needs of the local economy and the growing state and did what was in their power to adjust to changing realities.

The specific case of the University of the Pacific demonstrates the lasting educational legacy it had for California and that it also gave a boost to the political economy of the state. By beginning coeducational instruction in the state and allowing women to learn the same content as men, the University of the Pacific began the process of creating an educated populace that encompassed both sexes. While some schools taught just male students, such as Santa Clara College, and others taught just females, the University of the Pacific provided an early model for educating both men and women in the same classroom.

Additionally, the University of the Pacific emphasized science in the classroom. Santa Clara College was able to boast of its extensive laboratory equipment, and some of its professors had a scientific background. In spite of Santa Clara College's seeming advantage, the University of the Pacific did provide for scientific training and allowed students to opt for a bachelor of science degree before Santa Clara College had such a degree as well as after Santa Clara College had discontinued the degree. This demonstrated the responsiveness of the faculty and leadership of the University of the Pacific to the wants and needs of students and parents. For those students and parents that did not believe learning classical languages was necessary in order to succeed in the current economy, the University of the Pacific offered a collegiate program that allowed

them to receive a higher education degree that was perceived by society as more useful. Part of this degree included science classes. These science classes covered a wide range of subjects, including ones that spoke directly to the political economy of California by teaching students about surveying, mineralogy, and related topics.

As has been previously discussed, the economic considerations of the state were closely related to mining in the earliest years of statehood. This aspect of the political economy was crucial in bringing in enough of a population to grow the state and provide a workforce for the growth of infrastructure in California. Santa Clara College, St. Ignatius College, and the college campus of the University of the Pacific all contributed to this aspect by training individuals to enter the professional class in California and become leaders throughout the state.

Perhaps the biggest contribution to the state that the University of the Pacific made was with the establishment of the first medical school in California. Through the saga of the start of medical education in California, it is important to keep in mind the significance that training doctors within California had on the state's political economy. Even though the leadership of the college did not come up with the idea, the college supported it and allowed its name to be used in the endeavor. By being the first medical school, the medical department of the University of the Pacific provided a model for those that would follow, including that of the Toland Medical College. Not only did the first schools provide a model for future medical schools in the state, but they further developed the important healthcare infrastructure. Having more than one medical school in the state educated more locally-trained doctors, who could treat the population.

Additionally, caring for the state's citizens by providing health services was an important development in California history. Although medical services would not have been among the

main considerations for those entering the gold fields, as the state became more developed such services were arguably another important factor in deciding where to locate and how comfortable society would seem for women and children. While this “comfort factor” is difficult to quantify, undoubtedly individuals in the mid-1800s would have wanted to care for their families just as individuals do so in the twenty-first century. Likewise, the presence of doctors would also allow individuals to work longer and more productively throughout their lives. Doctors had, of course, immigrated to California and would continue to do so, but, with the population rising rapidly, more doctors were needed to keep up with the growing populace. Thus, these medical schools provided a valuable and fundamental resource through their training of doctors. These California-trained doctors, as well as the doctors that made up the medical schools’ faculty, saw patients, staffed hospitals, and ran pharmacies—all of which are important aspects of a developed society and ones that would foster further growth.

Having more than one medical school spurred competition. Doctors formed various and competing medical journals and organized professional societies. They sat on public health committees and taught future teachers about anatomy and human health. The future of cities and ensuring that they were safe for inhabitants was debated and informed by doctors as they participated in committees and served on governmental bodies. Through the pages of medical journals, doctors argued for changes and discussed the best methods for treatment of conditions seen in California.

The trajectory of the two medical schools—the University of the Pacific’s medical department and the Toland Medical College—continued to evolve over the course of the next few decades. The medical professionals that worked in the schools and were trained by the schools became leaders in the California medical profession, particularly through their contributions to

medical journals and professional societies. Other medical schools were also formed in this time, although many did not survive. Overall, the legacy of the University of the Pacific's medical department and the Toland Medical College was one that provided a critical piece of the societal and public infrastructure for California.

Beyond California in general, having the first medical schools located in San Francisco had advantages for both the schools and the populace. By being in the population center of California, the medical schools were able to draw upon the greatest concentration of doctors for faculty members. In addition, the hospitals that the students trained in were also located primarily in San Francisco and thus provided valuable and necessary experience for the students. Besides these reasons, the doctors consciously saw their location in San Francisco as a way to benefit the most people by being present where the greatest number of individuals could easily reach a doctor or hospital. Taken together, the ways in which the University of the Pacific affected the state of California through its science programs, both through collegiate and medical instruction, allowed the state to increase, in terms of economic, population, and general societal growth.

Chapter 4

Teaching the Teachers about Science: The California State Normal School

Introduction

From relatively early on in California's history, science was viewed as important for the state's citizens and for the political economy. In higher education institutions, science was practiced by professors who taught it to students in such fields as metallurgy, assaying, and medicine. These students would then be able to use this knowledge in mining and healthcare. Although this science education was restricted to only the small percentage of the population that actually attended colleges and universities, their higher academic achievement helped these individuals hold distinguished positions and were thus able to have a disproportionate effect on society. While in the first few decades after California statehood most individuals did not attend higher education institutions, many of them were, nevertheless, still exposed to science in other places. One primary place was in elementary and high schools. The teachers began to be increasingly educated in state normal schools—schools for educating future teachers—and passed on to their students the knowledge that they had acquired in these institutions. Thus, public education of science was important to California's political economy through teacher education.

Shortly before California became a state, the first "American" elementary school had opened. With statehood, more schools were started and even the first colleges, such as Santa Clara College and the University of the Pacific, had preparatory departments that were essentially high schools to prepare students to be able to take the collegiate classes. As the state's population grew and families became a larger part of California's demographics, the need for elementary and high schools, and of course teachers, increased.

In the 1850s, California had an increasing number of students in elementary and high schools. This occurred when the common school movement was fully developed as a major aspect of grade school education throughout the United States. In California, the common school movement was also a defining characteristic of education. The common school movement was important in providing a basis for education in the United States as well as trying to unite the nation in the antebellum period. Similar claims can be made about common school education in California in its first years of statehood as it developed as a society. Following the lead of other states, California had a state superintendent of public instruction whose job was to oversee public education in the state from elementary through high school. This office developed a number of the structures that began to standardize education in the state.

Elementary and high school teachers in California and throughout the United States often had little formal training and education beyond high school themselves. In general, some type of education credential was not required to teach. Each school district often had a great deal of autonomy in how it hired teachers, although having a state superintendent of public instruction began to increase the uniformity across the state as certain responsibilities were designated to that office's oversight. Nonetheless, for the first dozen years or so of California statehood, no systematic means existed for educating teachers within the state. Some teachers had been educated in normal schools in other states, but most still had no education beyond high school.

For most residents of California, the highest level of education would be a high school education, and many would not have even gone that far in school. With most not having the option of continuing into higher education, any further educational development inevitably came from organizations other than the typical educational institutions such as high schools, colleges, and universities. Although many individuals did not have the time nor inclination to seek

additional education, some sought out such opportunities. There were also private citizens who took it upon themselves to help provide the means for educating the general public.

For educating teachers, organizations were created in California to provide a solution to these needs. Normal schools were started—first a city normal school in San Francisco, then a state normal school, and later multiple branches of the state normal school. The normal school provided a means of educating a much wider segment of the California population than the early colleges could. Like the early California colleges, science was an important part of the curriculum—both formal and informal—of these institutions.

The Common School Movement and Beginnings of Normal Schools

The common school movement was the most important educational movement in the first half of the nineteenth century. Its importance warranted mention in the California state constitution as the basis on which schools in California were organized. The reforms of the common school movement allowed government and education to become much more tightly bound to each other. As such, a reflection of the main characteristics of the common school movement will also assist in a better understanding of the educational environment in California as the first state normal school was founded.

The common school movement primarily occurred during the 1830s and 1840s. Although a number of important education developments had occurred prior to this period, the common school movement had a profound effect upon American education since that time. One of the main effects was students moving from attending private schools to attending public schools in much larger numbers. In addition, the common school movement brought about standardized

systems of education under state control.¹

Within the common school movement, three main features emerged. Each of these related to political economy in some fashion. The primary characteristics of the common school movement brought schools and government closer together than ever before. In doing this, political, social, and economic goals were advanced. The first aspect was educating all children—from various religious, social, and ethnic backgrounds—in a single school building. It was from this that “common school” came to have a specific meaning identifying “a school that was attended in common by all children and in which a common political and social ideology was taught,” and it was hoped a place where “hostility and friction among social groups” would decline as the children were “taught a common social and political ideology.”² The second characteristic of the common school movement was having “a direct linkage between government educational policies and the solving and control of social, economic, and political problems.”³ Finally, “the creation of state agencies to control local schools” was the third feature of the common school movement.⁴ The agency most associated with control of local schools was the position of state superintendent of schools, first created in 1812 in New York. During the 1830s, organizing and supervising schools by states became a primary educational reform.⁵ Additionally, the common school movement helped to meet the needs of individuals and groups

¹Joel Spring, *The American School: From the Puritans to No Child Left Behind*, 7th ed. (Boston: McGraw-Hill, 2008), 78-79.

²Ibid., 79.

³Ibid.

⁴Ibid.

⁵Ibid., 79-80.

who were no longer adequately served by traditional education methods with the changes that had come about in society due to industrialization.⁶ The common school movement can thus be seen as having positioned education as a fundamental element in advancing the political economy of the early nineteenth century United States.

Another important educational development that occurred during the 1820s and 1830s was the beginning of the high school. The first high school opened in 1821 in Boston but did not become a widespread and fundamental institution throughout the country for another century in the 1920s and 1930s. High schools, similar to common schools it was argued, would instill republican and moral values and lead to obeying the law. The curriculum in high schools contained advanced science, mathematics, English, history, and political economy—subjects similar to that found in colleges of the period.⁷

The same education reformers that led the common school movement and established high schools also began to work to improve the educational system by preparing better teachers. They did this through establishing teacher institutes and normal schools on the premise that pedagogical methods could be taught. Teacher institutes began in 1839 in Connecticut and spread quickly throughout the nation. They were short (two to four weeks generally) teacher training courses that would meet once a year to provide education and moral improvement to current teachers.⁸

⁶H. Warren Button and Eugene F. Provenzo Jr., *History of Education and Culture in America* (Englewood Cliffs, NJ: Prentice-Hall, 1983), 97.

⁷Spring, 96-97. For a fuller exploration of high schools, see William J. Reese, *The Origins of the American High School* (New Haven, CT: Yale University Press, 1995).

⁸Spring, 149-151.

Before normal schools were created, neither what it meant to be a competent teacher nor methods for properly training a teacher existed. The first example of a school for teacher training was a private school in Concord, Vermont, in 1823. Other such private schools existed before Horace Mann founded the first public normal school in 1839 in Massachusetts. With the continued growth of the common school movement, the number of public school students greatly increased making formalized teacher training more important. In the ten years from 1850 to 1860, enrollment in public schools went from 3,350,000 to 5,000,000.⁹ Originally based on a Prussian model, normal schools varied in their quality and curricula nationwide, and those that graduated from them were better prepared for teaching than those that had not. In general, normal schools prepared future teachers for elementary school instruction, while teachers of high schools usually were graduates of college and universities. Most attendees at normal schools and teacher institutes were women, and many of the normal school students had only completed an elementary education before entering “higher” education. In general though, since normal school graduates made up a minority of elementary school teachers, most elementary teachers may have had little educational training beyond that of the elementary students they were teaching. Most of those that finished a normal school education did go on to teach, although many did not make teaching a lifelong career, choosing instead a different profession or, for the women, often marriage.¹⁰

Although there were variations in the curriculum from one normal school to the next, in

⁹Richard J. Altenbaugh and Kathleen Underwood, “The Evolution of Normal Schools” in *Places Where Teachers Are Taught*, ed. John I. Goodlad, Roger Soder, and Kenneth A. Sirotnik (San Francisco: Jossey-Bass Publishers, 1990), 136-138.

¹⁰*Ibid.*, 179; Spring 151-152.

general it consisted of much of what was taught in academies or public high schools with the addition of pedagogy and often observation and practice teaching in a model school, or a school where future teachers could practice teaching. This led graduates of normal schools to not be looked upon as highly as those who graduated from colleges or universities. Nevertheless, normal schools improved education in more than one way. Besides strengthening the quality of education in common schools, normal schools also drew students that might not otherwise be able to afford attending a college or university. Normal schools continued to be an important part of teacher education throughout the nineteenth century and into the early twentieth century. By the end of the 1920s, however, most normal schools had ceased to exist or had become incorporated into a larger institution.¹¹

Those that oversaw and ran normal schools throughout the United States in the mid-1800s viewed these schools as crucially important in the greater educational system. For instance, William Phelps, the principal of the New Jersey State Normal School, wrote a treatise in 1857 on the relation of normal schools to other educational institutions and to the welfare of society. Since the graduates of normal schools were employed as teachers of primary or common schools, they would play an important role in the development of children and thus “the welfare and progress of . . . society.”¹² Normal schools, he argued, would “serve to invigorate and intensify the entire social organization” and when conducted properly would through the teachers of

¹¹Alyssa Magee Lowery and William Hayes, *The Heart and Mind in Teaching: Pedagogical Styles through the Ages* (Lanham, MD: Rowman & Littlefield, 2014), 62, 66.

¹²William F. Phelps, *Normal Schools: Their Relations to the Primary and Higher Institutions of Learning, and to the Welfare and Progress of Society, together with Their Future in the United States* (Trenton, NJ: Office of the “True American,” 1857), 15.

primary schools do more “for the real welfare of society, than all other agencies combined.”¹³ At least for those involved with normal schools, it was seen that these schools were contributing to the public good in an important and profound way. In sum, Phelps’ line of reasoning was that a free government is based on ideas of virtue and intelligence throughout the people, and the people would acquire these ideas through mental and moral training in schools. The schools needed properly trained teachers, who would be educated through normal schools. Thus, in order for common schools to succeed in their mission of helping unify the nation and produce good citizens, common schools needed qualified teachers that would come from normal schools. Normal schools were viewed as playing a fundamental role in the betterment and welfare of society. The push for normal schools and teacher institutes in California in its first decade as a state demonstrated an effort to improve the quality of education in the state.¹⁴

Educational Beginnings in California

Before California had become a state, education had been present under both Spanish and Mexican rule. About fifty-five schools existed during that period with the schools located from San Diego to Sonoma. Reading, writing, arithmetic, and Spanish were taught. Besides government-run schools, there were private schools that offered classes in French, German, and

¹³Ibid., 16.

¹⁴Further information on the development of normal schools and teachers’ institutes can be found in chapters devoted to those subjects in James W. Fraser, *Preparing America’s Teachers: A History* (New York: Teachers College Press, 2007). A comprehensive study of normal schools can be found in Christine A. Ogren, *The American State Normal School: “An Instrument of Great Good”* (New York: Palgrave Macmillan, 2005).

Latin, and also bookkeeping and philosophy.¹⁵ One of the private schools that existed before the Gold Rush was an “American” grade school, which was established when immigrants from the eastern United States were just beginning to trickle into the then territory of California. Olive Mann Isbell opened what was later called “The First American School” in 1846 on the grounds of the Santa Clara Mission.¹⁶ The following year when she and her husband moved to Monterey, she opened a school in that location. Also in 1847, the first private school in San Francisco was opened, and the first public school in San Francisco began in 1848.¹⁷ Other schools, mostly private, were started throughout California especially after gold was found and California became a state.¹⁸

At the California Constitutional Convention of 1849, education was one of the issues discussed, and education became a part of the first state constitution. The debates surrounding education ranged from the need to have an educational system to allow individuals to be educated within the soon-to-be-state to how money should be allocated to an educational fund. A system of common schools was specifically discussed and included in the constitution.¹⁹

¹⁵Johanna Kasin Lemlech and Merle B. Marks, *The American Teacher, 1776-1976* (Bloomington, IN: Phi Delta Kappa Educational Foundation, 1976), 18.

¹⁶William Warren Ferrier, *Ninety Years of Education in California, 1846-1936: A Presentation of Educational Movements and their Outcome in Education Today* (Berkeley, CA: Sather Gate Book Shop, 1937), 13. It was called “The First American School” as it was the first grade school opened by an American following California’s acquisition by the United States. It was also in Santa Clara that California’s first two higher education institutions—Santa Clara College and the University of the Pacific—were started.

¹⁷*Ibid.*, 13, 19-24.

¹⁸*Ibid.*, 35-50.

¹⁹J. Ross Browne, *Report of the Debates in the Convention of California on the Formation of the State Constitution, in September and October 1849* (Washington, DC: John W. Towers, 1850), 202-211, <https://books.google.com/books?id=HfIJAAAAIAAJ>.

Article IX of the California Constitution of 1850 focused on education and had four sections. While the fourth section concerned higher education, the first three sections dealt with common schools and their supervision. Section 1 created the position of superintendent of public instruction, leaving the details of that office to future laws.²⁰ Section 2 called on the legislature to “encourage . . . the promotion of intellectual, scientific, moral and agricultural improvement.”²¹ This was similar to language used in Section 4 on the establishment of a state university (discussed in the following chapter). However, the rest of this section described how California would use funds gained from the sell of lands based on an 1841 Congressional act, among other sources of income, to financially support common schools.²² The delegates at the constitutional convention believed that the federal government “would allot considerable land to be used for school purposes.”²³ With a financial basis for common schools, Section 3 then decreed that the state legislature would provide for a system of common schools. These common schools in California were initially, according to the Constitution, set to only operate for a minimum of three months each year. If a particular district did not maintain such a common school, then that district could forfeit its part of the interest from the public fund.²⁴ The establishment and upkeep of a system of common schools had an important place in the California Constitution, and education in general was an aspect of California society that merited attention right from the

²⁰Ibid., ix.

²¹Ibid., x.

²²Ibid.

²³Paul Mason, “Constitutional History of California,” in *Constitution of the State of California and of the United States and Other Documents*, ed. California Legislature Assembly, (Sacramento: California State Printing Office, 1943), 380.

²⁴Browne, x.

beginning of statehood.

With much of the particulars of education outlined in the Constitution left up to the state legislature, its first session had education bills introduced. However, it took most of the 1850s before legislation passed that got California on a firm educational footing.²⁵ Additionally, while superintendents of public instruction were elected throughout the state's first decade, it was only as California entered the 1860s that the superintendent had a larger effect on California education with the first California teacher institutes and the establishment of the California State Normal School.

The need for competent teachers in California, and thus for a normal school to train them, was ever more urgent by the early 1860s. Most teachers received only a grammar school education themselves. These teachers with little more education than their students were by 1861 teaching 68,395 students, almost double from 35,722 in 1857. The number of schools had grown from 367 to 684 between 1857 and 1861 and the number of teachers had increased from 486 to 932. Thus, by May 2, 1862, when the California Legislature passed the bill establishing the California State Normal School, a sufficient demand was present for well-trained educators.²⁶

Founding of the California State Normal School

The first call for a state normal school in California came in 1853 by J. G. Marvin, the superintendent of public instruction. Four years later, the first normal school in California opened, although it was not run by the state but by the city of San Francisco. Known as Minns'

²⁵Ferrier, 1-12.

²⁶Benjamin Franklin Gilbert, *Pioneers for One Hundred Years: San Jose State College, 1857-1957* (San Jose, CA: San Jose State College, 1957), 17.

Evening Normal School, attendance at this school was compulsory for San Francisco teachers. Arguably the five years it was in existence before the establishment of the California State Normal School contributed to the awareness of the value of having a normal school. This value was also discussed by a subsequent superintendent of public instruction, Andrew J. Moulder, who renewed the discussion for a state normal school in 1861 in his annual report to the state legislature. He noted that in states that had a normal school, the teachers were superior and received higher compensation than their colleagues without such training. At this time, only eight other states (out of thirty-four) had normal schools before California, so although it took until 1862 for the California State Normal School to open, California was ahead of most states in its educational initiatives. Also in 1861, California had its first Teachers' Institute, and at this meeting in San Francisco in May of that year, the institute advocated the establishment of a state normal school. Moulder included this recommendation in his next report to the legislature, and in 1862 money was appropriated for the creation of a state normal school.²⁷

While few records exist from the earliest years of the California State Normal School when it was located in San Francisco,²⁸ the first principal of the school, Ahira Holmes, left a diary that contained a record of some of the most important events of the school. He began his diary on July 23, 1862, by noting that the school opened that day in accordance with the May 2, 1862, act of the California Legislature. Holmes then quoted that act and gave some background

²⁷Ibid., 327-329; Estelle Greathead, *The Story of an Inspiring Past: Historical Sketch of the San Jose State Teachers College from 1862 to 1928, with an Alphabetical List of Matriculates and Record of Graduates by Classes* (San Jose, CA: San Jose State Teachers College, 1928), 11, F870.E3S7522.G7, The Bancroft Library, University of California, Berkeley.

²⁸The lack of many records is likely due to the destruction that occurred from the San Francisco earthquake and fire of 1906.

on it. He referenced the Teacher's Institute of the year before, which had called for the founding of a normal school. Holmes also noted the three primary goals set out for the normal school based on the legislative act establishing it. The school was first to provide "a thorough review of the elementary studies," second to instruct in "those branches of knowledge which may be considered as an expansion of the above named elementary studies, or collateral to them," and finally to give attention to "the art of teaching, and its modes."²⁹ With this plan, the California State Normal School opened its doors to instruct future teachers.

The first location for the normal school was a classroom in a San Francisco high school building. While the plan was for a maximum of sixty students in the first term, this was optimistic at best as only six students were present when the school opened. By the middle of August, several more students had been accepted to the normal school bringing the first class up to twenty-one students, of which only two were male. These students were not as adequately prepared as might have been hoped, as Holmes noted in his diary. He wrote that they needed help in several subjects, including some mathematics and sciences such as algebra, natural philosophy, and physiology. Some students were admitted on probation but in general Holmes felt there were showing ambition and making progress.³⁰

By the end of the first session of the California Normal School in December 1862, there were thirty-one students (three of whom were male) that took an examination, although none were deemed qualified to graduate. Holmes noted the subjects the students had been instructed

²⁹Ahira Holmes, diary, July 23, 1862, Ahira Holmes Diary, 1, San Jose State Normal School Principals & Early Presidents Records, Series II: Ahira Holmes Diary, Box 4: Diary, MSS-2009-02-01, San Jose State University Library Special Collections & Archives, San Jose, CA.

³⁰Ibid., July 23, 1862 to August 15, 1862, entries.

in, which included reading, spelling, and geography as well as teaching methods in addition to courses of arithmetic, algebra, natural philosophy, and physiology. When school resumed in January 1863, geometry was added to the subjects taught. In this second term, thirty-six pupils attended, which included thirty-two females and four males. At the examination given at the end of the term in May, four students received diplomas. The examination was conducted by several individuals including the new superintendent of public instruction, John Swett, and Holmes as well as Henry Gibbons, one of the founding professors at the University of the Pacific's medical department.³¹ As will be seen, Gibbons was not only interested in medical education but in education in general. His involvement with the State Normal School and other educational activities demonstrates a commitment to education on his part as well as how those involved with science and medicine interacted with the education of teachers and thus a wider swath of Californians.

California Teachers' Institute and Science

May 1863 saw not only the graduation of the first four teachers from the California State Normal School but also was the month of the next California Teachers' Institute, also held in San Francisco. John Swett, as the current state superintendent, was the ex officio president of the convention. Among the several vice presidents was Andrew Moulder, the previous state superintendent, several county superintendents, the San Francisco city superintendent, and Henry Gibbons. When the institute opened on May 4, 1863, the total number of members was 463.³² At

³¹Ibid., December 21, 1862, to May 14, 1863 entries.

³²California Department of Public Instruction, *Proceedings of the California State Teachers' Institute, In Session at the City of San Francisco, From Monday, May 4th, to Saturday,*

the institute, science and mathematics were addressed several times throughout the six-day session. Discussions ranged from textbooks to be used in instructing those subjects to opportunities for the members to learn more about scientific subjects while they were in San Francisco.

Opportunities to learn about science came from both outside of the Teachers' Institute as well as from presentations made during the meetings. The members of the Teachers' Institute received a couple of invitations to visit organizations in San Francisco that could provide them with learning opportunities. One was from the Mercantile Library Association (an organization with an aim to increase the literary and scientific knowledge of the city) to visit their library and reading room.³³ The Academy of Natural Sciences also extended an invitation for visiting their facility that would be open to the educators throughout the time of the institute. Swett stated that the Academy had the "largest collection of mineral and other specimens in the State," and it being "an extremely valuable and interesting collection," he urged those members "who had never visited it to avail themselves of the invitation."³⁴ How many members accepted the invitations was not recorded, but the invitations themselves note the connections being made between grade school educators and the larger scientific world.

However, the educators did not have to leave the institute in order to gain new scientific knowledge as speeches and presentations were made on science subjects during the meetings. On the second day, the evening session was devoted to a talk given by George W. Minns, a vice

May 9th, 1863, (Sacramento, CA: State Printer, 1863), iii, 9.

³³*Ibid.*, 11.

³⁴*Ibid.*, 22.

president of the Teachers' Institute and a professor of natural sciences at the San Francisco High School. He lectured on the physical geography of the United States.³⁵ Perhaps not surprisingly as the talk came during the midst of the Civil War, Minns emphasized that the physical geography of the United States demonstrated "that the whole land was designed for one and only one nation."³⁶ Besides this assertion that there should be one nation and not two, Minns argued that the study of physical geography led individuals "implicitly to believe that God made all that greets [one's] eyes, and that when He had made it, His eye, critical beyond all created perceptions, saw it very good."³⁷ This was one of the few overt references to God made at the institute, and it was perhaps from Minns' religious and scientific beliefs that he connected geography to the issue at the forefront of the national divide—that of slavery. In his discussion of the connections of physical geography and the development of the human race, Minns praised characteristics of different groups from Europe that had immigrated to the United States. He concluded this section by targeting slavery, calling it a devil and a "monstrosity [that] must be annihilated—that devil must be slain."³⁸ While in general the Teachers' Institute was concerned with more mundane matters such as the selection of the best textbooks, speeches such as Minns' served to provide a connection for the teachers between educational subjects, including those of science such as geography, and events going on around them. This made explicit that these educators were part of the public sphere and had the opportunity to do public good, not only

³⁵Ibid., 19.

³⁶Ibid., 20.

³⁷Ibid., 19.

³⁸Ibid., 21.

through the general education of children but also by providing them with moral guidance backed by scientific ideas of the day.

Other scientific presentations were educational in other ways, if not as stirring in their rhetoric. A “model school” class, that being a class from a school where student teachers could practice pedagogical methods under the supervision of experienced teachers, recited a lesson on optics. While the scientific content was perhaps known to much of the audience, the educators in attendance may have gained insights into how to present such scientific material to their classes. Later that same day, the state geologist, a Professor J. F. Whitney, delivered a lecture on the naturalist Alexander von Humboldt.³⁹

Besides speeches on scientific topics, other addresses touched upon the place of the normal school and education of the state’s children in the context of the larger society. On the first day of the Teachers’ Institute, secretary of the institute Samuel I. C. Swezey delivered an address on the general subject of state normal schools. He spoke on the value that a normal school provided to the larger community and the level of knowledge that could be expected from graduates of the normal school as well as what the graduates would be able to impart to their future pupils. In short, Swezey provided a rationale for the creation of normal schools and for how they fit into the overall educational system. Swezey’s basic argument involved the ways a state normal school would benefit the political economy of the state. He noted that a state normal school was to benefit not the few but the many, not preparing students for specialized careers such as engineers or military officers but to prepare teachers who can instruct students in subjects “common to all occupations and professions” allowing each student to choose wisely and thus

³⁹Ibid., 25-26.

“enable him to make the most of himself as a true man in the State through after years.”⁴⁰ Swezey thus linked teaching done by graduates of normal schools to the success of the state.

Additionally, Swezey described the relation between education in a normal school and in colleges and also differences in level of mastery of knowledge. He stated that normal schools were interested in the success of colleges but that the differences in the type of education received in each were most apparent in teaching children. Individuals coming from colleges that had received instruction in “higher Algebra, Surveying, and the classics, with a proud self-consciousness of their ability as scholars,” soon realized that their training was not sufficient for teaching in an elementary classroom.⁴¹ Having a college education did not portend success in teaching in grade school. Swezey commented that it was “not always the greatest mathematician who can best explain to a class in the Public Schools the processes of the fundamental rules in arithmetic” but rather through drills “by which the real principles of elementary arithmetic were developed” with these teaching methods being acquired in normal schools.⁴² For the students they teach, “the value of their Normal training cannot be estimated.”⁴³ In making another contrast with college education and the level of mastery students would gain in comparison to that of normal schools, Swezey noted that public school teachers did not need “to be masters of Latin, and Greek, and Sanscrit; neither [should they be required] to understand the mysteries of the chemist’s laboratory, nor the details of civil engineering. . . . [T]he Normal School . . . must aim

⁴⁰Ibid., 97.

⁴¹Ibid., 100.

⁴²Ibid.

⁴³Ibid.

to make good scholars . . . not hope to make great ones.”⁴⁴

While Swezey did not believe advanced chemistry or engineering knowledge should be required of normal school students, he nonetheless did have a place for the study of mathematics and science in general. Both mental and written arithmetic he felt were important and needed thorough review as did elements of algebra, geometry, and plane trigonometry. As normal school students would be teaching mathematics, they must have great accuracy in their work. “A mistake in addition, or in any of the fundamental rules, is to be ranked as a grave failure,” Swezey commented.⁴⁵ In the natural sciences, Swezey argued that physiology was most important for both the health of the teacher and the teacher’s students, all of whose health he said was dependent on knowing the laws of the body in relation to exercise, habits, and positions.

When it came to natural philosophy and chemistry, Swezey believed that bookkeeping was of more use than those scientific subjects if a teacher had to choose between them.⁴⁶ He based this on a pragmatic argument that most citizens of the state would obtain their “only regular education” in public schools and general bookkeeping principles were more important for the “system in private affairs of business among the masses of citizens [from which] the prosperity of the community must always so largely depend.”⁴⁷ This was not to say that Swezey saw no place for natural philosophy and chemistry. He stated that facts and principles of those subjects should be mastered as they would “open so large a field for amusement, and [awaken]

⁴⁴Ibid., 103.

⁴⁵Ibid., 107.

⁴⁶Ibid., 103.

⁴⁷Ibid.

intellect among the children who might otherwise pass along through life almost ignorant of the relations of the matter around them, when a few words weekly in their schooldays would bring many minds into immediate and healthful contact with Nature.”⁴⁸ Swezey, thus, took an approach whereby he worked to balance what he saw as important to the political economy with what was important to the general knowledge and welfare of students.

To allow teachers to best teach these subjects, Swezey noted the need for scientific apparatus in normal schools. Using apparatus in normal schools would provide the future teachers with ways of teaching science even if in their future schools they did not have the full set of apparatus provided in the normal school. Normal school students should recognize how they could conduct smaller scale experiments and demonstrations.⁴⁹ Through learning how to teach with an apparatus and the basics of scientific knowledge, normal school students would gain a “standard by which to be guided in their more humble attempts to diffuse a knowledge of science among the people.”⁵⁰ This is one of the clearest statements on how normals schools, through their graduates, conveyed scientific knowledge to the general public. As Swezey had previously stated, most individuals would not go to college so what education they received would most often be in public schools. It was, therefore, incumbent upon those teachers to be well educated, such as could best be done in normal schools, so that public school students could get at least some scientific knowledge. This knowledge should also include geology, especially in California, Swezey noted, likely referring to the political economy of the state and the

⁴⁸Ibid.

⁴⁹Ibid., 103-104.

⁵⁰Ibid., 103.

importance of mining.⁵¹ Even if students would not attend a college like Santa Clara College, where mining and metallurgy were given prominence by the professors, the general populace could have a basic understanding of scientific ideas based on what was taught them in public schools by graduates of normal schools.

John Swett, the superintendent of public instruction and president of the 1863 Teachers' Institute, also addressed the fact that common school teachers would be providing the only formal education that most individuals would ever receive. Common sense was needed for teaching in the common schools and for educating boys who would mostly go on to become "farmers, miners, mechanics, and laborers" and girls who would mostly become "the wives of farmers, miners, mechanics, and laborers."⁵² Swett then commented on what subjects ought to be taught for children who would have the types of occupations he had mentioned. Reading, writing, and spelling he considered to be practical skills, more practical than math, although math would be needed by individuals in order to correctly keep accounts.⁵³ Knowing that mathematics, then as now, could be a frightening prospect for some students, he cautioned not to let arithmetic "be the great nightmare of the School to squeeze out all the vitality from the scholars."⁵⁴ Swett also advised teaching some knowledge of geography, history, music, physical activity, and science subjects of physiology, hygiene, and natural history. With so much that could be taught, Swett noted that the teacher should expect much would remain untaught.⁵⁵

⁵¹Ibid., 104.

⁵²Ibid., 125, 127.

⁵³Ibid., 127.

⁵⁴Ibid.

⁵⁵Ibid., 127-129.

Another speaker at the 1863 Teachers' Institute spoke more explicitly about the relation between colleges and normal schools. Unsurprisingly, this speech was from the president of a college. Samuel H. Willey was the president of the College of California.⁵⁶ In his address, he discussed how the college was positioned between primary instruction in common schools and professional and business education. Such professional education could include going to other schools for law, theology, medicine, or science as well as to a normal school, obviously a place near to the heart of his listeners. Like Swezey, Willey also discussed scientific apparatus as a crucial part of an educational institution's facilities. Used for illustrating various scientific subjects, the apparatus went along with the natural history cabinet comprised of specimens gathered from nature.⁵⁷

Willey then spoke on the importance of colleges. Noting that while individuals patronized institutions that tended "to increase the valuable productions of the country—the excellence of the stock, the growth of grain, the yield of the mines, or the profits of trade," the college was "an institution that augments the nobler power in the land—the intellect, the *mind*; . . . The College is an institution in which youth . . . become men . . . ready to learn any profession, or enter upon any pursuit."⁵⁸ With an audience of teachers whose students would mostly never attend college, Willey also emphasized the importance of the common schools. He reiterated the aims educational reformers had for the common school movement by stating that in the common school "the youth of the country, whatever may be their nationality or their religion, are blended

⁵⁶The College of California was located in Oakland and would be important in the development of the University of California as will be discussed in the next chapter.

⁵⁷*Ibid.*, 118-120.

⁵⁸*Ibid.*, 121 (*italics in original*).

into one people . . . these Schools . . . breathe the spirit of patriotism, and [students] learn something of the history and laws of our Government.”⁵⁹ Relating common schools with colleges, he argued that common schools created “the necessity for the College.”⁶⁰ Finally, Willey praised the educators by linking their work to the public good. Again stressing the mind, he said that “those who work directly on the *mind* of the country as educators . . . are employed upon that which enters into the very life of the public welfare.”⁶¹ Willey thus used his address to link education in common schools to that of the colleges as well as to the public good and political economy of the society. His speech, like others at the Teachers’ Institute, demonstrated how educators viewed their work and their belief that a normal school education could affect wider society.

Early Years of the California State Normal School and Science

Following the Teachers’ Institute, the Normal School reopened on August 30, 1863, with thirty students. By this time, nine of their preceding students were teaching throughout the state, a fact that could provide comfort to the new students in knowing their time in normal school could help them get a job. In this new school year, instruction included physiology, botany, and natural philosophy, with object lessons and charts supplementing the lectures. The lectures for physiology and botany were given by Dr. Henry Gibbons. His involvement thus took an even more direct turn from assisting in examining the students to work at the Teachers’ Institute to

⁵⁹Ibid.

⁶⁰Ibid., 122.

⁶¹Ibid., 123 (*italics in original*).

actually teaching in the Normal School.⁶² When that session ended on December 22, Gibbons gave one of the closing addresses along with Swett and two previous superintendents. According to Holmes, Gibbons' remarks included "some very happy and forcible suggestions to the Scholars relative to their duties as pupils of the first Normal School established in California."⁶³ What those suggestions were, Holmes unfortunately did not record. Gibbons had undoubtedly had several opportunities to give his thoughts to the future teachers with his teaching in the school. Holmes' diary stated that by the end of the term Gibbons had also lectured on chemistry. As a note to the end of the fall 1863 session, Holmes noted that the standards for the school needed to be raised to attract better students who were turned off from attending due to the lower standards of their prospective classmates.⁶⁴

With the end of 1863 came reports on education and the California State Normal School. One report was by Superintendent of Public Instruction John Swett. In his report, he included portions of the Revised School Law of 1863 that pertained to the State Board of Education and the issuance of teaching certificates and state educational diplomas. Under it, the State Board of Education was granted the authority to conduct examinations by which to ensure prospective teachers were qualified to teach. Those that passed received a teaching certificate. One section of the law listed the specific subjects for which that teaching candidates would be examined. These included reading, grammar, spelling, geography, history, penmanship, and drawing as well as object teaching. Science and mathematics were also part of the examination with several subjects

⁶²Holmes diary, June 1, 1863 to September 1, 1863, entries.

⁶³Ibid., December 22, 1863, entry.

⁶⁴Ibid.

such as algebra, arithmetic, natural philosophy, and physiology. In each of these subjects, the applicants would undergo a “full and critical examination.”⁶⁵ In commenting on this provision of the law, Swett argued that it enabled teachers to be deemed competent and held in respect by fellow teachers with the object that they would be teaching in public schools and not in institutions of higher learning. He made the point that it was proper that higher mathematics, along with the classics and modern languages, were not included in the examination for the diploma since these were subjects not for the common schools but for higher education.⁶⁶ Swett thus argued for a differentiation in what needed to be known by teachers of different educational levels. Science and math subjects, as the law stated, would be core disciplines for which teachers of the common schools would be expected to know and teach. These would be the subjects, among others, that would be taught in the State Normal School so that the graduates would be able to pass the examination and be competent teachers of common schools. In stating what would not be included in the examination, such as higher mathematics, Swett in his commentary on the law sought to elevate within society the status of teachers and show that they should be recognized for possessing the knowledge they needed to teach and not be expected to have command of subjects that were rightly taught in colleges and universities.

With the California State Normal School having barely opened, Swett in his 1863 report took the opportunity to advocate for additional financial support from the state. He made his case by giving a comparison of how other states and countries educated their teachers through normal

⁶⁵John Swett, *Thirteenth Annual Report of the Superintendent of Public Instruction of the State of California, For the Year 1863* (Sacramento, CA: State Printer, 1863), 38, Rules and Regulations and Course of Study of the California State Normal School, F870.E3 C2 1863 no.1, The Bancroft Library, University of California, Berkeley.

⁶⁶*Ibid.*, 40.

schools. Swett provided examples of the success found in other states and the amount of money that had been spent on the normal schools.⁶⁷ Then, he argued that since other states had found normal schools to be an integral part of their school system California should be able to maintain a normal school as well. This ought to be especially true, he continued, when the state had spent \$75,000 to build a reform school and \$100,000 on school buildings for the “Deaf, Dumb, and Blind,” meaning there should be no hesitation on spending \$8,000 for the annual appropriation for the normal school.⁶⁸ While the State Normal School would become successful and open additional branches, in the first years that outcome was not certain and the state’s Superintendent of Public Instruction found a need to make a case for its continued support.

Alongside Swett’s report were also reports from the “Board of Trustees of the California State Normal School” and the “Principal of the State Normal School.” The board’s report focused mainly on the finances of the institution and how having a successful normal school would allow the state’s common schools to have more success as well. The board, which included Governor Leland Stanford as well as Swett, complained that the legislature’s 1862 appropriation (which was initially \$3,000 before an additional \$1,200 was added) “was totally inadequate to the maintenance of the School, and had not the Board of Education of San Francisco generously supplied the means that were lacking, this institution, whose establishment has been so long and so earnestly desired by all the friends of proper education in the State, would have terminated a painful existence.”⁶⁹ As Swett had argued for his report, the board

⁶⁷Ibid., 49-55.

⁶⁸Ibid., 53.

⁶⁹George Tait, *Report of the Board of Trustees of the California State Normal School* (Sacramento, CA: State Printer, 1863), 186-187, Rules and Regulations and Course of Study of

advocated an appropriation of \$8,000 for the coming fiscal year. In spite of the financial difficulties, the board nonetheless reported that the Normal School's success "has exceeded the expectation of its friends."⁷⁰ Finally, the board asked the legislature to consider that the success of the State Normal School was the best way of raising the standard of the Common Schools if they had properly trained teachers enabling California's public schools to be the best schools in the state.⁷¹ The board thus took an optimistic view assuming that the state legislature provided better funding in the years ahead.

In the report by the principal of the school, Ahira Holmes, gave an overview of the first year of the State Normal School, similar to what he recorded in his diary on the school, as well his thoughts on how to make the school as success. He discussed the opening of the school and the first pupils as well as the course of study. As Holmes had described in his diary, he bemoaned the lack of preparation of many of the first students.⁷² While Swett and the board had mentioned the need for more financial support from the state in order for the school to prosper, one issue that Holmes found to be an impediment to getting more students was the lure of gold and "unsettled spirit" of both young men and young women of California.⁷³ Holmes included in his report a section on what he felt needed to happen in order for the school to be successful. One

the California State Normal School, F870.E3 C2 1863 no.1, The Bancroft Library, University of California, Berkeley.

⁷⁰Ibid., 188.

⁷¹Ibid.

⁷²Ahira Holmes, *Report of the Principal of the State Normal School* (Sacramento, CA: State Printer, 1863), 192-196, Rules and Regulations and Course of Study of the California State Normal School, F870.E3 C2 1863 no.1, The Bancroft Library, University of California, Berkeley.

⁷³Ibid., 197.

way he believed this would happen would be to elevate the profession of teaching in general so that as teachers were looked upon with more esteem by society the teachers would take their job more seriously and thus improve the schools they taught in. Furthermore, perhaps somewhat at odds with Swett who had described why higher mathematics should not be part of the diploma examination, Holmes argued for teaching the students of the Normal School additional mathematics and science beyond what they would actually be teaching once they obtained a job. Holmes wrote that it was necessary for the Normal School students to understand the elements and advanced principles of such subjects as algebra, geometry, natural history, physics and rhetoric. He then gave a math and science example stating that to understand and teach arithmetic well one needed to have some knowledge of higher mathematics and that understanding astronomy would allow one to grasp geographical science. Having a greater base of knowledge to draw upon would allow a teacher to be better equipped to teach more rudimentary subjects.⁷⁴ While he did not advocate that diplomas should be awarded based on more advanced knowledge, Holmes clearly made the point that in his ideal normal school the students would be taught lessons that might be expected to be found in colleges or universities.

Holmes continued his diary in 1864, and in his first entry for the year, he wrote down his thought on the standards of the students at the school. He argued that what was “most needed to increase the prosperity and promote the usefulness of our infantile Normal School [was] better ‘material’—or rather better disciplined minds.”⁷⁵ This lack of better ‘material’ had resulted in the school spending much of the class time teaching rudimentary material and basic scientific

⁷⁴Ibid., 199, 202.

⁷⁵Holmes diary, January 5, 1864, entry.

principles rather than the “more legitimate work of the School,” which consisted of more advanced material and more emphasis on pedagogy.⁷⁶ In addition to better prepared students, Holmes recorded that the school needed additional materials to better instruct its students. These materials included a reference library, geological cabinet, and scientific apparatus for physics, astronomy, and mathematical geography as well as various other appliances.⁷⁷ When the next session of the school opened a few days later, the number of students had doubled to sixty.⁷⁸

During the first days of 1864, Holmes had evidently procured some of the items he had mentioned the school needed. Several textbook publishers donated a number of books and others were purchased. This allowed the students to have proper textbooks as well as form the basis for a library. The geological cabinet began with contributions from students and other individuals.⁷⁹ Students continued to bring in mineral samples, including ones of copper, iron, silver, and gold ores from parts of California, Arizona, and Nevada.⁸⁰ Marine plants and more minerals, such as borax and sulphur, were contributed.⁸¹ These contributions demonstrate the value that students and community members placed on having a better basis for learning about the natural world, especially that of minerals, which were so important to the state in its earliest years.

As the winter 1864 term continued, Holmes wrote in the school diary that the San Francisco City Board did not seem to see value in the Normal School as they did not have

⁷⁶Ibid.

⁷⁷Ibid.

⁷⁸Ibid., January 7, 1864, entry.

⁷⁹Ibid., January 11, 1864, entry.

⁸⁰Ibid., January 20, 1864, entry.

⁸¹Ibid., February 10 and 26, 1864, entries.

personal experience with it and were “unjustly prejudiced against it.”⁸² Some students had evidently dropped out of the Normal School on the basis of the City Board indicating that such an education would not help them in getting a job.⁸³ This must have been a disappointing turn of events for Holmes as he worked to get the school off the ground. A couple months later, he reported that at the end of two years the school had enrolled 126 students, of which twelve were male, from nineteen counties. However, most students were of a “low grade of scholarship.”⁸⁴ In spite of this discouraging assessment, after the school year had ended Holmes noted that demand for graduates of the Normal School was increasing (even if perhaps not in San Francisco).⁸⁵

In the following school year, more progress was made with the State Normal School. The library expanded to about 1,100 books. Publishers continued to donate books, including an encyclopedia of natural science and a book on natural philosophy besides the usual mathematics and science textbooks as well as non-science books.⁸⁶ Early in that same session, a formal connection was made between the California State Normal School and the Mechanics’ Institute of San Francisco. The Mechanics’ Institute had a somewhat similar mission of helping to educate a wide segment of the population, albeit adults rather than the children that graduates of the Normal School would teach. It did this through a library, lectures, and a scientific and technological exhibition at the annual Mechanics’ Fair. The Mechanics’ Institute president sent a note to Holmes inviting the teachers and students to attend the Mechanics’ Fair being held then

⁸²Ibid., March 18, 1864, entry.

⁸³Ibid.

⁸⁴Ibid., May 20, 1864, entry.

⁸⁵Ibid., June 15, 1864, entry.

⁸⁶Ibid., August 20, 1864, entry.

in Union Square in San Francisco. This invitation was well received as Holmes noted that the school members “seemed highly pleased with their visit.”⁸⁷ What other connections and visits, if any, may have been had between the Normal School and the Mechanics’ Institute were not recorded, at least by Holmes. However, this visit indicates an awareness of each other’s organization and mission by these two organizations both dedicated to educating the public, including on scientific grounds. While the State Normal School and the Mechanics’ Institute had different types of education they were providing, both were ultimately concerned about allowing the general populace to receive an education. The State Normal School did this through educating future teachers that would instruct the state’s children, and the Mechanics’ Institute provided programs and resources for adults. This interest by the Mechanics’ Institute in the State Normal School coupled with the case of Henry Gibbons teaching at both the University of the Pacific’s medical department and the State Normal School demonstrates that in the small world of early San Francisco there was definite interest in supporting the work of the State Normal School.

The State Normal School also expanded its ability to teach anatomy and physiology. A manikin was bought at a price of \$800, with half of the amount coming from the San Francisco City Board of Education (which perhaps had a more favorable view of the school than had previously been seen). A Mrs. Young was hired to teach the anatomy and physiology class, which evidently was not mandatory as it cost an additional \$1.25 per pupil to attend the lectures. In spite of the cost, thirty-five students signed up for the class.⁸⁸ Even with scientific learning

⁸⁷Ibid., September 16, 1864, entry.

⁸⁸Ibid., November 1, 1864, entry.

costing extra, over half the students were willing and wanting to gain that knowledge.

The following year, more additions were made to the scientific collection. In January 1865, Holmes reported that over the vacation “considerable additions” had been made to the mineral cabinet and about forty stuffed bird specimens had been collected.⁸⁹ About a month later, while the students were away on a field trip, Holmes spent his free time by “arranging, labeling and classifying the specimens” in the Cabinet and also “obtaining specimens of birds for the same in the vicinity of the City.”⁹⁰ The Cabinet now had around four hundred specimens of minerals and fossils in addition to shells, marine plants, and stuffed birds (the preparation of the birds done by a taxidermist who had moved from New York). Holmes was also hopeful that scientific equipment in the form of some philosophical apparatus would be donated soon to the State Normal School from the San Francisco Board of Education since the city’s high school had recently received a new, complete set.⁹¹ Later that same month, Holmes noted that more additions had been made to the Cabinet.⁹² Unfortunately, Holmes did not record whether the philosophical apparatus was ever donated since the last entry in the school diary simply noted San Francisco celebrating Union victories on March 4, 1865, the day of Lincoln’s second inauguration. Following this entry, a note was made in the diary stating that Holmes made no further reports.⁹³

⁸⁹Ibid., January 15, 1865, entry.

⁹⁰Ibid., February 22, 1865, entry.

⁹¹Ibid.

⁹²Ibid., February 25, 1865, entry. He also mentioned that the Federal forces had occupied Charleston, South Carolina, resulting in a salute from the San Francisco Bay forts.

⁹³Ibid., March 4, 1865, entry.

Nonetheless, the diary of the State Normal School continued, albeit only sporadically through 1866. Much of the rest of the diary contained listings of books and students. Of note was the reason for no additional entries by Holmes. This was due to a change in leadership as in June 1865 a new principal was named, George W. Minns, previously principal of the San Francisco Boys' High School.⁹⁴ Of the entries for 1866, one in January mentioned the introduction of a botany class for the seniors in the school.⁹⁵ The final entry for 1866 (and the final diary entry other than a listing of students) came in December with another new principal, Henry P. Carlton, recording that Ahira Holmes had taken away the cabinet of stuffed birds. Holmes took this step due to a dispute with the State Board of Education over his pay and his belief that this was the only method to collect his payment, something that Carlton did not feel could be defended in any circumstance. How this issue was eventually resolved is not known, but a note added to the diary stated that the cabinet was returned in 1867.⁹⁶

Henry P. Carlton served as principal of the California State Normal School from 1866 to 1867 and another brief period in 1868 during his overall time at the school from 1863 to 1873. He had been born in Massachusetts and for a time worked in the insurance business before sailing around Cape Horn to California in 1853. In California, he served as principal of a couple of grammar schools and briefly served as Swett's deputy in the public instruction office. During his time at the Normal School, the main subjects he taught were mental philosophy, natural history, and physiology. Besides teaching about science, he also was a major contributor to the

⁹⁴Ibid., June 1865 entry.

⁹⁵Ibid., January 15, 1866, entry.

⁹⁶Ibid., December 11, 1866, entry.

school's museum. He collected almost all known shells—both land and freshwater—of the Pacific Coast. Carlton was recognized for both his educational and scholarly work by the University of California, which awarded him one of its first honorary degrees.⁹⁷

One of the early students at the California State Normal school was Arthur Rodgers. Originally from Tennessee, he had been a lawyer before coming in 1864 to California, where he made a career change by becoming a student at the State Normal School and later graduating in 1866.⁹⁸ While attending the school and following his graduation, he sent letters to a cousin Alice. In one letter, he mentioned that out of ninety students, eighty were female.⁹⁹ He also wrote that they had regular debates.¹⁰⁰ The year following his graduation, he wrote another letter to his cousin in which he noted he was the teacher of twenty-four students at a school in Woodside, California.¹⁰¹ Although there is no record of what he actually taught to the students, his teaching certificates that he obtained in 1866 and 1870 list the subjects in which he had proficiency.

⁹⁷Greathead, 130.

⁹⁸“Arthur Rodgers Becomes a Benedick,” San Francisco *Chronicle*, May 16, 1895, 8, Arthur Rodgers correspondence: ALS, 1865-1902, Folder 7: “San Francisco Chronicle article about Arthur Rodgers and Mrs. Elizabeth A. Montgomery wedding May 16, 1895,” BANC MSS 2004/224 cz, The Bancroft Library, University of California, Berkeley.

⁹⁹He intimated that the few young men at the school had a very pleasant time. Arthur Rodgers to Alice, May 24, 1866, Arthur Rodgers correspondence: ALS, 1865-1902, Folder 1 “Arthur Rodgers letters to cousin Alice Sept. 1865 to May 1867,” BANC MSS 2004/224 cz, The Bancroft Library, University of California, Berkeley.

¹⁰⁰*Ibid.*

¹⁰¹Arthur Rodgers to Alice, May 2, 1867, Arthur Rodgers correspondence: ALS, 1865-1902, Folder 1 “Arthur Rodgers letters to cousin Alice Sept. 1865 to May 1867,” BANC MSS 2004/224 cz, The Bancroft Library, University of California, Berkeley.

Among these were arithmetic, algebra, physiology, and natural philosophy.¹⁰² He was thus prepared to teach these subjects and likely did teach aspects of them depending on the grade level of his students demonstrating at least in part the science and mathematics education that students of the Normal School graduates received. Rodgers' teaching career did not last too long as by 1872 he was a graduate of the University of California and subsequently became a regent of the institution.¹⁰³ Even though his years of teaching were brief, his career shows that a graduate of the State Normal School could obtain a teaching job, which included teaching mathematics and science, and continue on to other successful pursuits.

While knowing more about the early years of the State Normal School would be helpful, what the diary does contain provides the best source for this period. It also shows what was going on from the inside of the school and listed some of the frustrations that went with starting a new endeavor. Holmes also shed light on how others in the community aided in the development of the State Normal School and took an interest in the project, including in way of scientific education.

Science and the California State Normal School in San Jose

As the 1860s came to a close, a permanent location was sought for the California State Normal School. Eventually, the state legislature settled on San Jose. On June 14, 1871, the California State Normal School officially opened in its new location in San Jose. Until the

¹⁰²Teaching Certificates, Arthur Rodgers correspondence: ALS, 1865-1902, Folder 6: "Arthur Rodgers Teaching Certificates 1866, 1870," BANC MSS 2004/224 cz, The Bancroft Library, University of California, Berkeley.

¹⁰³"Arthur Rodgers Becomes a Benedick."

building to house the school was completed, the school occupied some rooms in the high school building and then in the grammar school building. By July 1872, enough of the new building had been completed to allow the State Normal School to begin to occupy it. It stayed there until a fire destroyed the building in early 1880.¹⁰⁴

As the California State Normal School had continued to grow at its location in San Jose, the Legislature created a southern branch in 1881. This southern branch was opened in 1882 in Los Angeles, where it continued until 1919 when the southern branch of the University of California was established at its location. The teacher education of what had been the Los Angeles State Normal School continued in the University of California's southern branch as the teacher training division.¹⁰⁵

Besides being one of the longest-serving principals from 1873 to 1889, Charles H. Allen also was a principal with scientific interests. Born in Pennsylvania, he gained mechanical skills, which he used as a land surveyor. He worked in education in New York and Wisconsin before going to California. There he was first the professor of natural history before becoming principal of the school.¹⁰⁶ His scientific interests went beyond teaching, and in his adopted state of California he took much interest in the state's plants, even creating detailed descriptions of

¹⁰⁴Greathead, 12-13.

¹⁰⁵Greathead, 14. By 1913, there were a total of eight normal schools throughout the state so the school located in San Jose was no longer called the California State Normal School but rather each school now was designated by the city it was located in. The eight schools (with years of founding) were as follows: San Jose (1862), Los Angeles (1881), Chico (1887), San Diego (1897), San Francisco (1899), Santa Barbara (1909), Fresno (1911), and Humboldt (1913).

¹⁰⁶Ibid., 133-134.

wildflowers.¹⁰⁷ It was during his tenure that the Normal School faced one of its greatest challenges in having to rebuild from the devastating fire of 1880.

As would be expected for a school educating future teachers, the California State Normal School included in its curriculum mathematics and science. By 1872 when the school had moved to San Jose and after a decade of instruction, the curriculum was more settled. Among the subjects taught were several aspects of mathematics. These included algebra, mental and written arithmetic, geometry, mensuration, and trigonometry. The natural sciences curriculum category included astronomy, chemistry, natural philosophy, and natural history consisting of studying botany, mineralogy and geology, physiology, and zoology.¹⁰⁸ The course of study remained fairly constant for the next several years, with the addition of students learning “household science” beginning in 1876.¹⁰⁹ These subjects show the breadth of what the normal school students were to learn. Although these students were in general preparing to teach in elementary level grades, much of what they were studying was little different from what students in other colleges of the time were studying as well.

¹⁰⁷Gilbert, 63.

¹⁰⁸California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the Academic Year Ending March 28, 1872* (San Jose, CA: Office of the Mercury, 1872), 12, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA.

¹⁰⁹California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the School Year ending March 31st, 1876* (Sacramento, CA: State Printing Office, 1876), 25, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA. Household science was defined as “the application of chemistry to the home life.” *Ibid.*, 38.

One of the State Normal School students in the early 1880s kept a teaching notebook that included thoughts on science and mathematics. Ella Kelly had graduated from Marysville High School in 1878 before attending the State Normal School. As she completed her courses at the normal school, she recorded her notes on pedagogy in a notebook dated to 1883. As no lecture notes from the time survive, her notebook provides a glimpse into what the students were being taught that they would then carry forward as they went out to teach throughout California, as Kelly did when she returned to Marysville to work in the public school.¹¹⁰ The view of science that she held was that it was “knowledge reduced to order.”¹¹¹ Furthermore, education was meant to “strengthen the faculties of the mind.”¹¹² When it came to mathematics, she recorded that memorization had little place in that subject.¹¹³ Above all, logic, reason, and understanding were what defined mathematics.¹¹⁴ In the instruction of mathematics, pedagogically arithmetic could be broken up into two parts—namely, “the operation and the logical part.”¹¹⁵ Additionally, teaching math required the teacher to explain in an objective fashion. This could be aided by the

¹¹⁰California History Section, California State Library, “Teaching Notebook, 1883-1909,” Online Archive of California, <http://www.oac.cdlib.org/search?style=oac4;ff=0;institution=California%20State%20Library::California%20History%20Room;query=kelly;idT=AFS-2359>.

¹¹¹Ella L. Kelly, “Teaching Notebook, 1883-1909,” 19, SMC II Box 20 Folder 4, California History Section, California State Library, Sacramento, CA.

¹¹²Ibid.

¹¹³Kelly was also apparently thought that it was lazy to have fly leaves of math books covered with examples and statements. Rather, once a concept was understood there was no longer a use for it. Thus, examples should be worked out with a pen rather than being able to easily erase the work which would lead to carelessness. Ibid., 21.

¹¹⁴Ibid.

¹¹⁵Ibid., 87.

use of an abacus.¹¹⁶ Kelly's notes offer an insight into how the faculty and students understood science and mathematics. These areas of knowledge were orderly and logical. They were also ones where students could learn logic and how to reason through careful practice and use of examples. Even from early grades, mathematics and science were important topics for students to learn.

Another way of gauging the interest in science by students at the California State Normal School is through their extracurricular activities. One of the groups that many of the students attended was the Erosophian Literary Society. This society had regular meetings with lectures, readings, and debates, some dealing with scientific issues. For instance, in 1874 and 1875 the students debated such issues as whether the classical or scientific course of study was better for a "useful career," whether geometry was a "profitable" subject of study for normal students, and whether studying natural sciences was more "profitable" than studying mathematics.¹¹⁷ One meeting included a lecture on phenology.¹¹⁸ These meetings of the Erosophian Literary Society demonstrate that mathematics and science, or at least the teaching of them, were topics for consideration and contemplation outside of the classroom. The future teachers of California were taking an interest in science beyond what they had to learn and took time to work to understand such subjects. While the debates and lectures in their student society were undoubtedly on topics

¹¹⁶Ibid., 87-88.

¹¹⁷Erosophian Literary Society, Records of the Erosophian Literary Society, State Normal School, San Jose, January 2, 1874, February 12, 1875, February 19, 1875, State Normal School Records, San Jose, Series IV: Student, Faculty, and Alumni Records and Publications 1863-1927, Box 33: Normal School Societies Minutes and Records, MSS-2010-04-01, San Jose State University Library Special Collections & Archives, San Jose, CA.

¹¹⁸Ibid., January 9, 1874.

that as teachers they would not cover in their classrooms, being exposed to such concepts would have given them a better base of knowledge from which to communicate scientific ideas to the children of California.

Just as the curriculum had settled with the permanent move to San Jose, the move also allowed the school to set up a museum, cabinet, and library. In the catalogue for the first full year in San Jose, the school listed that the California Legislature had appropriated \$3,000 for apparatus purchases and \$1,000 for library purchases. It was also stated that because the school was now in a permanent location, former students and “all friends of education” were asked to send donations for the library and cabinet.¹¹⁹ The following year, the catalogue reported that minerals from the East Coast and lead and zinc specimens from the Mississippi Valley had been set up in the museum. What the school now needed was a full collection of minerals from the Pacific Coast, which it was argued would require “but little effort” since the area was “so rich in mineral depositions.”¹²⁰ By 1874, the museum was still lacking the Pacific minerals but the apparatus was almost complete. Charts, maps, and “fine anatomical models” were present and apparatus for illustrating chemistry and natural philosophy had been ordered.¹²¹ Perhaps because

¹¹⁹ *Catalogue and Circular of the California State Normal School 1872*, 15.

¹²⁰ California State Normal School, *Catalogue of the California State Normal School, San Jose, for the Academic Year Ending March 27, 1873* (Sacramento, CA: T. A. Springer, State Printer, 1873), 18, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA.

¹²¹ California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the School Year Ending March 26, 1874* (Sacramento, CA: G. H. Springer, State Printer, 1874), 23, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special

the California State Normal School was a state institution, it had to rely on donations to make up what was not provided by the state legislature. Other schools, such as Santa Clara College or the University of the Pacific, also discussed their cabinet and apparatus in often glowing terms, but unlike the State Normal School, they did not have to seek donations to the same extent in order to have a complete museum, cabinet, or apparatus.

With the catalogue for 1876, donations were still being solicited but some had also been coming in as the catalogue was updated with a larger collection for the museum and cabinet. A collection of shells had been purchased, and a California bird collection was nearly complete. Donors were specifically thanked for mineralogical specimens that had been sent to the school. The apparatus continued to be added to, and the existing equipment provided students to have instruction with “actual” experiments and allowed them to learn how to use such apparatus in the Common Schools that they would soon teach in.¹²² This note in the catalogue provides one of the strongest pieces of evidence of how what was taught in the State Normal School was expected to be passed on to the schoolchildren of California. As had been previously described, the apparatus included materials for anatomy, chemistry, and natural philosophy. These scientific subjects, then, were deemed important and appropriate for even grade school children to be taught.

The additions to the museum and cabinet continued until the fire on February 10, 1880. This fire destroyed the building and almost everything in it, having “burned to the ground” the Normal School building and destroyed “nearly all the costly and excellent apparatus, all the

Collections & Archives, San Jose, CA.

¹²²*Catalogue and Circular of the California State Normal School 1876, 26-27.*

reference library, most of the maps, charts, and other appliances.”¹²³ Additionally, the cabinet, museum, “valuable scientific works,” and “the extensive herbarium, the result of years of patient labor in collecting and arranging, were entirely lost.”¹²⁴ Thankfully for the education of the students, after just one day the school was able to continue temporarily in the San Jose high school building.¹²⁵ This did not, of course, solve the issue of a permanent building or of replacing all that had been lost. The state legislature appropriated \$100,000 and another \$50,000 was collected from insurance toward the rebuilding effort, which also allowed for the purchasing of new apparatus. However, as the school’s circular stated, “money [could] never replace the cabinet and museum” but the “replacement must be the work of time, and of the generous contributions of the friends of the school.”¹²⁶ Showing the value that the school and the museum and cabinet collection held to “friends of the school,” a number of contributions had already been donated to the school by the printing of the circular. These donations included ferns, shells, minerals, and ores.¹²⁷ Such a loss must have been demoralizing at best to the school leaders and those that worked on the museum and cabinet. Nonetheless, they and others quickly got to work to rebuild and replace as best as could be done and in as timely a manner as possible what had

¹²³California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the School Year ending May 20th, 1880* (Sacramento, CA: State Office, J. D. Young, Supt. State Printing, 1880), 22, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA.

¹²⁴*Ibid.*

¹²⁵*Ibid.*

¹²⁶*Ibid.*, 23.

¹²⁷*Ibid.*, 29.

been lost.

By the following year, it was reported that the new building had been completed and the apparatus replaced. The museum had received donations that created a collection valued at \$2,000, containing specimens of ores, minerals, shells, plants, and even lava and coral from throughout California and Nevada and places as far away as New Guinea and Arabia. The botany department also took in specimens to restart the herbarium. In the year since the fire, more than 3,000 specimens had been donated.¹²⁸ By 1882, the museum's collection was valued at \$4,000 with more donations continuing to come in.¹²⁹ Subsequent years brought new donations and continued increases to the value of the collection found in the museum, cabinet, and herbarium. The commitment to these aspects of the school by students, alumni, faculty, and friends as well as devoting multiple pages of each year's catalogue to describing the collections indicate that science deserved attention and should have a prominent place in the California State Normal School through both outreach efforts as well as in the curriculum and life of the school. Science was seen as being important as not just a subject to be taught but also one to be experienced through hands-on use of apparatus and up-close examination of plants, shells, minerals, and ores.

¹²⁸California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the School Year ending June 2d, 1881* (Sacramento, CA: State Office, 1881), 24, 42-44, 46-48, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA.

¹²⁹California State Normal School, *Catalogue and Circular of the California State Normal School, San Jose, for the School Year ending June 1st, 1882* (Sacramento, CA: State Office, 1882), 28, Series I: San Jose State Normal School and San Jose State Teachers College Course Catalogs, 1872-1935: Box 1: San Jose State Normal School Course Catalogs, Date Range: 1872-1916, Record Group: 9.2, San Jose State University Library Special Collections & Archives, San Jose, CA.

Conclusion

The California State Normal School provided a different type of higher education than Santa Clara College, the University of the Pacific, or the University of California, to name the three most prominent educational institutions of the 1850s to 1870s. Like the University of California, the California State Normal School was a public institution, although (as will be examined in the next chapter) without a strong source of funding. Like the preparatory departments that could be found in Santa Clara College or the University of the Pacific, the California State Normal School could be seen as providing something equivalent to a high school education for at least some of its students. Like all of these other educational institutions, the California State Normal School took pride in its descriptions of its scientific apparatus, cabinet, and museum collections. Science, with a different purpose in mind than might be found at the other institutions, was an important part of the educational environment at the California State Normal School.

The educational mission of the California State Normal School was, in a crucial way, broader than that of other higher education institutions in the state. It sought to not simply provide education to individuals but to provide an education that these individuals would then go forth and disseminate to the children of California, many of whom would likely never attend a college or university. Although at first the number of students was quite small, as with other educational institutions the numbers increased over time and the reach of its education continued to grow. Thus, the science taught at the California State Normal School had a potentially far greater reach than the science taught at other California higher education institutions. The science at the school may not have had the same depth and complexity as seen elsewhere, but what science was there was of a kind that would be more relevant and sometimes useful to a general

population and not necessarily for those that would be going into scientific or technical professions.

What the science education at the California State Normal School provided was a way for science to be accessible to a wider swath of the California population. The science taught through classes as well as through the use of the apparatus and collections found in the museum, cabinet, and herbarium was done with the same seriousness and energy as done elsewhere, even if the level of the subject material was different. Furthermore, the science was taught with an often practical purpose in mind. The collections at the school were California-based, thus helping the students to learn the native flora and fauna that they could then teach to their future students and thus increase the scientific literacy of the state. While other colleges and universities in California contributed in other ways to the state's political economy, the California State Normal School helped the state's citizens, starting with its youngest pupils, know more about science and provided an important part of the overall educational system that would make California a more prosperous state.

Chapter 5

The Land Grant College and Science: The College of California and the University of California

Introduction

From even before California became a state in 1850, higher education had been a part of the California discussion. In the Constitutional Convention of 1849, delegates discussed having a state university and included it in the state constitution. However, while some efforts were held to create such an institution, these were in vain until the federal Morrill Act of 1862 was passed. Six years later, with funding from the Morrill Act, the University of California was finally established.

In the meantime, private institutions had stepped in to provide education in the state. Among those institutions was the College of California, located in Oakland. It, like many other early higher education institutions, was affiliated with a particular religion or denomination. Similar to the other schools, the College of California responded to the needs of the political economy in the type of educational programs it provided, as it aimed to better serve the needs of the state and attract students. This included having science and technology programs that were directed at the mining industry. However, unlike some of the other early schools, like Santa Clara College and the University of the Pacific, the College of California was not as successful. Thus, when the Regents of the University of California were searching for a location for the new university, the College of California's leaders were willing to turn over their campus and faculty to the state's new institution. The University of California was therefore first located in Oakland with the faculty and campus of the College of California before the University of California

permanently moved to Berkeley.

Establishing a land grant college through the Morrill Act was important in California's political economy by allowing a state educational institution to begin providing science and technology education. This came nearly two decades after higher education was enshrined in the state constitution and several attempts were made to establish a state university. Despite initial struggles, the state benefitted from the work that had been done by private schools in California, such as the College of California with its science and technology programs. The University of California also used the financial resources from the Morrill Act to create an institution that was in line with the spirit of the law even if some did not believe it was always holding to the letter of the law. Nonetheless, the university that was created through the Morrill Act was such that agriculture and the mechanic arts were important, but not the sole, aspects of the university. This enabled the University of California to be on a strong footing as it continued to grow to eventually become a world-renowned educational institution.

Early Efforts to Create a State University

The first efforts to found a state university in California began in 1849 at the state constitutional convention. There, Samuel H. Willey, the chaplain of the convention and a minister from Monterey, proposed that the state have a public university. With his support, the state constitution included a provision for the use of state lands to fund a university.¹ The first three sections of Article IX of the California constitution drafted in 1849 dealt with electing a

¹Irving G. Hendrick, "From Indifference to Imperative Duty: Educating Children in Early California" in *Rooted in Barbarous Soil: People, Culture, and Community in Gold Rush California*, ed. Kevin Starr and Richard J. Orsi (Berkeley: University of California Press, 2000), 244.

superintendent of public instruction and a system of common schools. Finally, section four provided for the establishment of a state university. The first part of the section stated how such a university would be funded (through the rental or sale of land), while the latter part of the section indicated what the purpose of the university should be. The constitution noted that the university should have “such branches as the public convenience may demand, for the promotion of literature, the arts and sciences.”² The framers of this document seemed to have the political economy in mind when specifying that the demands of “public convenience” would dictate branches taught in the university. Additionally, the sciences (along with literature and the arts) were to be promoted. From well before the University of California would be founded, science would be positioned to have a central place in higher education.

Just a month after California became a state in September 1850, the *Daily Alta*, one of the leading newspapers in California’s early years, published an editorial regarding the establishment of a state university. Recognizing the need for having a system of common schools first, the paper also described the role of a state university. Together with other educational institutions, this would allow California to have “one of the best systems of education in the world.”³ A state university would be a necessity for California sometime in the future, even if not at the present time. This was, in part the *Daily Alta* noted, because California was not just welcoming primarily men anymore but also women and children who accompanied or came to meet husbands and fathers. In due time, a large enough college-aged population

²“Constitution of the State of California 1849,” California Secretary of State, <http://www.sos.ca.gov/archives/collections/1849/full-text.htm>.

³“State University,” *Daily Alta* (San Francisco), October 3, 1850, 2.

would be present to justify the need for such an institution.⁴ The following day, the *Daily Alta* continued its argument by concluding that, while California at some point would need a university, it may be better handled by private interests than by the state.⁵ Indeed, it would be private colleges, like the College of California, that provided higher education for nearly two decades before a state university finally was established.

The following week, after having established that California needed a university, no matter if it was run privately or publicly, the *Daily Alta* continued its look at higher education by addressing what subjects should be taught and would be most useful. The paper's basic answer was a course of studies that would "most effectually train the mind for future development and educate it most thoroughly for those duties and employments in life to which it is presumable the student will be devoted."⁶ Acknowledging that this might be easier in theory than practice, the newspaper went on to propose subject areas that it viewed as more or less useful. Mathematics was one subject singled out for being "always advantageous and strengthening to the reasoning faculties" without which "no education is complete."⁷ However, the newspaper continued that most of the present educational system, including the study of ancient languages, did not have the same advantages, although Latin was useful for those pursuing law or medicine. Far more useful than studying Greek or Latin, though, was bookkeeping, according to the newspaper. The paper argued that a college or university in California needed to have a different course of study than had been generally found in higher education. This changed course of study needed to be

⁴Ibid.

⁵"State University," *Daily Alta* (San Francisco), October 4, 1850, 2.

⁶"Colleges," *Daily Alta* (San Francisco), October 7, 1850, 2.

⁷Ibid.

one that was useful and would fit with the needs and wants of the people.⁸ Essentially, the *Daily Alta* was contending that any college or university in the state had a duty to meet the needs of the political economy. This was combined with the necessity to provide the type of education that would advance the interests of the state as a whole. The type of education the *Daily Alta* called for included at least mathematics, but as has been seen elsewhere in this dissertation and is argued in this chapter, the importance of studying mathematics and science was the ways these subjects could allow students to contribute to the political economy of the state.

Early efforts to create a state university began in 1850 with members of the state legislature. A main component of the justification for organizing a state university was science and what teaching it would offer to the state. In 1850, Thomas J. Green, a California state senator from Sacramento, began to work in the legislature to organize a state university. To get additional assistance for the project, he wrote to Robert J. Walker, a former United States senator from Mississippi and former Secretary of the Treasury.⁹ Green possibly hoped that with Walker's experience, connections, and knowledge of political and physical sciences, Walker could provide California with a plan to get a state university funded and in operation. In a November 1850 letter to Walker, Green described his vision for a state university. With California still in the midst of the Gold Rush, Green stated that California "must be the greatest mineral region of the earth."¹⁰ This led him to conclude that "minerals and mining should be the

⁸Ibid.

⁹I have not been able to find any indication of why Green reached out to Walker in particular, other than possibly his support of funding for education when he was Secretary of the Treasury as discussed below.

¹⁰Thomas J. Green to Robert J. Walker, November 25, 1850, *Journals of the Legislature of the State of California at Its Second Session: Held at the City of San Jose, Commencing on the Sixth Day of January, and Ending on the First Day of May, 1851* ([Sacramento, CA?]: State Printer, 1851), 759, <https://books.google.com/books?id=Eg5FAQAAMAAJ>.

leading branch” taught in the university.¹¹ Second to this was instruction in the study of political economy and free trade principles, with the reasoning for this being that Californians had to buy everything they ate and wore and the fuel used to cook their food.¹² The Gold Rush had provided the sudden increase in population leading to statehood, and it was thus no surprise that mining would be a state legislator’s most important area of study to be taught.

In reply to Green’s letter, Walker noted that others had more knowledge of the physical sciences, although he had made the subject of political economy a study throughout his life. However, if the state legislature did select him for this project, he would be willing to do so as long as he could have the assistance of individuals known for their scientific achievements and devotion to educational causes.¹³ Foreshadowing the Morrill Act (discussed below), Walker recollected how, when he was Secretary of the Treasury, he had recommended to Congress the use of lands to provide funds for schools. He told Green that provisions of the California Constitution and the great gold wealth of the state would allow a university to be well endowed financially. Such a university, he argued, needed to include all sciences, both physical and “hyperphysical.”¹⁴ Walker agreed with Green that mining should have a special place at the proposed university. He stated that mines and mining should be among the most important of all the departments, as it was the occupation of a majority of California’s population. Looking

¹¹Ibid.

¹²Ibid.

¹³Robert J. Walker to Thomas J. Green, November 26, 1850, *Journals of the Legislature of the State of California at Its Second Session: Held at the City of San Jose, Commencing on the Sixth Day of January, and Ending on the First Day of May, 1851* ([Sacramento, CA?]: State Printer, 1851), 760-761, <https://books.google.com/books?id=Eg5FAQAAMAAJ>.

¹⁴Ibid., 761.

beyond when gold and other minerals would be easy to find, Walker called for an agriculture department to be included, as he believed that in time a large portion of the state's people would be in that occupation. Additionally, commerce and political economy should be a main focus of the university. In order to benefit from the mineral resources, California needed to engage in trade. Walker argued that while most politicians and governments tried to place restrictions on commerce, having free commercial trade would be a benefit for California and people in general. A California university should make the study of commercial trade one of its subjects, and the university should help spread the truth about its benefits to the world.¹⁵ This was because, in Walker's estimation, commerce was the "great agent of civilization" and a "friend . . . of the . . . sciences" as well as of peace, the arts, and music.¹⁶ Walker saw a direct linkage between science, education, and political economy and that a California university could bring these together.

In 1851, the state legislature established a board and charged it with acquiring a site valued of at least \$20,000. Although the board found some suitable land in San Jose, the state Supreme Court did not approve.¹⁷ By the time a state university was ultimately established in 1868, Walker was not involved with it and Green had died years before. Their brief correspondence includes many of the same issues that were still present nearly two decades later. Indeed, the letters of the two men provide evidence that, from the early conceptions of the University of California, the institution was thought of as having an important role to play in the political economy of the state and that science would be a key aspect of the university and how it functioned in the state and its economy.

¹⁵Ibid., 761-762.

¹⁶Ibid., 762.

¹⁷Hendrick, 244.

The College of California

Efforts by the state to establish a state university did not come to fruition in the 1850s, and, during that time, Samuel Willey, the state constitutional convention chaplain who had advocated for creating a state university, moved from Monterey to San Francisco, where he continued working as a minister. He became good friends with Henry Durant, a Congregational minister and graduate of Yale. Together with the help of other Congregational and Presbyterian ministers, they began their own school in Oakland in 1853.¹⁸ Durant wrote to one of his correspondents that year about how the two denominations were working together to create a school. He also stated that there was a need for an educational institution on the Oakland side of the San Francisco Bay.¹⁹ The western side of the bay already had Santa Clara College and the University of the Pacific in Santa Clara and soon would have St. Ignatius College in San Francisco. Initially, the school founded in Oakland was for high school students, and in 1855, it received a state charter as Contra Costa Academy. Three years later, seeking to create a better permanent location for the school, 140 acres were purchased in Berkeley. By 1860, the school became known as the College of California.²⁰

With the school now a college, Henry Durant and Martin Kellogg—both Congregational ministers and both later to be significant presidents of the University of California—became the College of California’s first professors. When the University of California was created, Durant became its first president from 1868 to 1872, while Kellogg would first be a professor of Greek

¹⁸Ibid.

¹⁹Henry Durant to [Rev. J. Noyes], September 30, 1853, Durant family letters, 1845-1882, BANC MSS 77/73 c, University Archives, The Bancroft Library, University of California, Berkeley.

²⁰Hendrick, 244.

and Latin before becoming the seventh president in the 1890s when the University of California had increasing institutional growth.²¹

Science at the College of California

In the 1860s, the College of California endeavored to have science become a more important part of the school's offerings. Like the science curriculum at Santa Clara College and the University of the Pacific, the increased emphasis on science and technology at the College of California correlated with the needs of the state's political economy with mining and agriculture both being important parts of the economy. Also like Santa Clara College, the College of California had professors that were recognized for their scientific expertise. For instance, William H. Brewer, who held a master's degree, was a member of the State Geological Survey. In resigning his professorship in 1864, he noted that his work on the survey was taking up all of his time.²²

At the College of California, the students studied mathematics and science throughout their course of studies. The freshman class studied algebra and plane geometry while the sophomores studied navigation and analytical geometry in their mathematics class. The sophomore class also had instruction in trigonometry, mensuration, and surveying. Martin Kellogg noted in an 1862 report that the college needed sufficient philosophical apparatus for the junior class and soon needed a laboratory with chemical apparatus, estimated at about \$2,000.²³

²¹Ibid., 244-245.

²²William H. Brewer to Trustees of the College of California, April 22, 1864, Letter book of the College of California, 1849-67, Item 30, 308y.let, University Archives, The Bancroft Library, University of California, Berkeley.

²³Martin Kellogg, "Report #6: Report of Progress for 2d Term, 1861-62," Reports of the College of California, 1858-1866, 308y.r, University Archives, The Bancroft Library, University

In a report for the following school year, Kellogg estimated \$5,000 in expenses for scientific apparatus.²⁴ This apparent projection of expenses demonstrates the commitment that the College of California had to improving its scientific equipment.

In 1864, the College of California established a college within itself—the Mining and Agricultural College, which had the Department of Science and the Arts. In setting out its mission, the catalogue of the College of California listed four objectives for the new department. First, it aimed to provide “scientific and professional education of Miners, Metallurgists, Chemists, Agriculturists, Engineers, Mechanics, and Architects.”²⁵ A second objective was to have resources related to mining and geology. These resources would include a mining museum, geological and mineralogical cabinet, scientific and technological libraries, and chemical and metallurgical laboratories. All of these would have a focus on California but also include materials from nearby states and around the world. Third, the department sought to create an agricultural museum that, like the one for mining, would have samples both from California and elsewhere in the world and would include machines and other implements. Finally, the department intended to establish an office of records that would compile data and create statistics for mining, agriculture, and other industrial and economic activities.²⁶

Besides having four objectives, the Mining and Agricultural College had four courses of

of California, Berkeley.

²⁴Martin Kellogg, “Report #8: Report on Finances and General Statement,” Reports of the College of California, 1858-1866, 308y.r, University Archives, The Bancroft Library, University of California, Berkeley.

²⁵College of California, *Catalogue of the College of California and College School: Oakland, California, 1864-65* (San Francisco: Towne & Bacon, 1864), 15, <https://hdl.handle.net/2027/loc.ark:/13960/t6zw26h6z>.

²⁶Ibid.

instruction. These were in mining and metallurgy, engineering, agriculture, and general and applied science. Graduates would either receive an engineering degree or a bachelor of philosophy degree depending on their course of study. Initially, the college only had two professors (both with master's degrees) to teach these subjects, while several other professorships were proposed to complete the department. The first professors were responsible for the fields of mineralogy, geology, and mining and also mine construction and surveying. The proposed positions included professors in chemistry and metallurgy, agriculture and botany, physics and mechanics, mathematics and astronomy, civil and topographical engineering, geology and paleontology, architecture, assaying, modern languages, and drawing. In spite of these plans, the catalogue stated that classes had not yet been organized. This "unexpected delay," as it was termed, was blamed on an "extraordinary depression of mining interests" that had occurred in the previous year.²⁷ Nonetheless, the school still hoped to attract students.

The effort to create a program was reported by William P. Blake, the director of the department. In May 1864, he presented to the College of California's president and board of trustees on what had happened thus far. Advertisements for the Mining and Agricultural College had been placed in two major newspapers—the *Sacramento Union* and the *San Francisco Bulletin*. From this came two responses. One was a young miner who wished to attend but could not make his way to the area at the present time. The other was from a gentleman in San Francisco who planned on attending classes once they were organized. In addition to these two possible students, Blake noted that a young gentleman from Virginia City, Nevada, wished to study mining but was unable to. However, Blake and the man had made arrangements to do a reading

²⁷Ibid., 16.

course with Blake and attend lectures as possible. Besides this “student,” there was interest from an officer in the Imperial Russian Mining Service, who wanted to attend lectures and visit mines if he was able to get permission to do so. Blake discussed these four individuals, he said, in order to demonstrate to the board the difficulty in finding students who would be able to leave their current occupations in order to study in the college.²⁸ If not having students to attend the school was not enough of a problem, Blake reported that the institution faced “bitter and unscrupulous opposition” from the state geologist. Additionally, the laboratory had most of the equipment but was still missing some key parts that were coming from New York and Germany.²⁹

The plan that the College of California had for its Mining and Agricultural College was ambitious, to say the least. Had it succeeded in the ways the school leaders undoubtedly hoped it would, the College of California might have been on a different track and not felt the need to ultimately offer its assets to the state to begin the University of California. This episode in the College of California’s history can provide some lessons in how a college interacted with the state’s political economy with respect to science education. As I have argued in this chapter and dissertation, colleges in California sought to both respond to and provide for the changing political economy of the state. Certainly, the College of California was no different than other colleges of the era in this respect. Although the excitement of the Gold Rush had died down by the 1860s, mining and associated enterprises like metallurgy were important to the continued development of the state. With this economic reality, the College of California sought to get into the business of educating those who would be working in the mining industry. The college

²⁸William P. Blake to President and Board of Trustees of the College of California, May 20, 1864, 1, 3, Letter book of the College of California, 1849-67, Item 32, 308y.let, University Archives, The Bancroft Library, University of California, Berkeley.

²⁹Ibid., 4-5.

leadership likely had two reasons for doing this. First, from a marketing standpoint and for the pure survival of the school, offering a curriculum that could attract additional students and show that the school was on the cutting edge of education would only enhance the reputation of the school and enable it to better compete for the limited number of individuals who would be prepared for and interested in attending higher education. Second, having the school offer such a curriculum and provide a scientific and technical education for individuals participating in one of California's most important economic activities would benefit the political economy of the state as it continued to develop.

Having the College of California turn over its assets (and debts) to the state was an act that both helped the state and the college. When the state was in need of a location to begin its university, the College of California provided not only the land but also the buildings and faculty. This transfer helped a struggling institution relieve itself of debt and provide a way out rather than simply closing the school's doors. However, it also allowed the state to begin the University of California immediately rather than waiting for months or years for buildings to be constructed and faculty to be recruited.

The Morrill Land Grant College Act of 1862

In spite of efforts early in the state's history, it was not until the Morrill Land Grant College Act of 1862 that California was able to establish its own state university. The passage of this legislation set in motion the events that led to the dissolution of the College of California and the establishment of the University of California. When the Morrill Act was signed into law, the Civil War was still in the first years. In these early stages, when the military campaigns were not yet going that well for the Union side, the United States Congress still took up important

pieces of legislation that had consequences throughout the rest of the nineteenth century and beyond. The Morrill Act was one such bill. Officially titled “An Act donating Public Lands to the several States and Territories which may provide Colleges for the benefit of Agriculture and the Mechanic Arts,”³⁰ this act helped bring about the establishment of institutions of higher education, including the University of California, throughout the entire United States.

The Morrill Land Grant Act was sponsored by Justin Smith Morrill, a United States representative from Vermont. He served first in the House of Representatives and later in the Senate from 1855 until his death in 1898, making his political career of forty-three years in Congress the longest of anyone at that time in United States history.³¹ Early in his Congressional career, Morrill began to work on legislation that would help finance agricultural colleges. He believed “that a curriculum focused on practical sciences ‘would do the greatest good to the greatest number.’”³² He first introduced legislation in 1857, and his bill passed both houses of Congress in 1859. However, arguing that the bill was unconstitutional, President James Buchanan vetoed it. In December 1861 with a new president and a Congress with significantly fewer members due to the absence of Southern members because of the Civil War, Morrill introduced a revised version of his legislation. This time when the votes took place in 1862, both houses of Congress passed it with wider margins of victory, even though Westerners were opposed to it out of concerns of having land in their states used to pay for schools that would be in the East. President Abraham Lincoln signed the Morrill Act into law on July 2, 1862.³³

³⁰Coy F. Cross II, *Justin Smith Morrill: Father of the Land-Grant Colleges* (East Lansing: Michigan State University Press, 1999), 92.

³¹*Ibid.*, xiii. Cross’s *Justin Smith Morrill* provides a useful biography of Morrill.

³²*Ibid.*, 79.

³³*Ibid.*, 79-84.

The law stipulated that for each Congressional representative and senator every state would receive 30,000 acres of public land. Western states, which still had public land, had that amount of land sold directly by public officials. Other states without such land instead received scrip, which the states sold to individuals so as to not have one state owning another state's land. These individuals redeemed the scrip for land, which they could then sell. The money from the sale of land or scrip was invested by the states into government or other safe investments. In order for a state to receive the funding provided by the Morrill Act, the state had two years to agree to the law's provisions and five years to establish a college.³⁴ Initially progress was slow in securing funding under the act as federal land was flooding the market. Besides the Morrill Act, federal land was also being sold with the passage of the Homestead Act and the transcontinental railroad law as well as land that veterans of the Mexican War and various Indian Wars had received. Nonetheless, states did follow through on the Morrill Act, and other laws providing funding for higher education in the areas of agriculture and the mechanic arts were passed, including a second Morrill Act in 1890.

By the end of the twentieth century, more than 100 institutions were part of the Land Grant College system. Out of these institutions came eleven United States presidents. Compared to all higher education institutions in the country, the land grant college institutions were responsible for twenty million degrees, and these degrees included one third of all master's degrees awarded and more than half of the doctorates granted. Additionally, the Morrill Act also broadened the scope of American education as it allowed higher education to be opened to the working class, immigrants, blacks, and other minorities.³⁵ Women were also able to enter

³⁴Ibid., 84-85.

³⁵Ibid., 85-88. The inclusion of minorities in these institutions was dependent on other factors as well, such as the local political conditions of the land grant institution. Nonetheless,

education in higher numbers through the Morrill Act. The law had not specified coeducation but had not mentioned “men” either but rather “classes.” State legislatures, not wanting to spend more money creating separate institutions for women, included women when they established land grant colleges.³⁶ This led, by 1890, to every state including in their land grant charters the admission of women.³⁷

As stated in its official title, the Morrill Land Grant College Act was designed to bring about education in agriculture and the mechanic arts. Having been passed during the Civil War, the legislation also had provision for military science education. Morrill himself spoke of the objectives he saw for the bill he had sponsored. He emphasized what he saw as the national character of the schools and the value they would have for the nation. He argued that such colleges as “ ‘national colleges should place scientific or practical studies foremost as the leading object, and whatever else might be added, that these were in no case to lag in the rear.’ ”³⁸ Furthermore, Morrill believed that there should be “ ‘a system of broader education for the American people . . . especially in agriculture and the mechanic arts.’ ”³⁹ With this type of education, the colleges could be seen as being national in scope because in addition to being

the land grant colleges provided more opportunities for minorities than had many other educational institutions.

³⁶Alison Comish Thorne, “Visible and Invisible Women in Land-Grant Colleges, 1890-1940,” *Utah State University Faculty Honor Lectures*, Paper 2 (1985), 2.

³⁷Andrea G. Radke, “Women in Higher Education,” *Encyclopedia of the Great Plains* (University of Nebraska-Lincoln, 2011), <http://plainshumanities.unl.edu/encyclopedia/doc/egp.edu.040>.

³⁸Frederick B. Mumford, *The Land Grant College Movement*, Missouri Agricultural Experiment Station, Bulletin 419 (Columbia: University of Missouri, College of Agriculture, 1940), 18 (italics in original).

³⁹*Ibid.*, 19.

funded through the federal government their purpose and nature was to “promote the general welfare.”⁴⁰ Undoubtedly for Morrill and others that voted for his piece of legislation, the nation’s welfare, especially in a time of war, in addition to the political economy of the country, was paramount in their minds as they considered what land grant colleges could do for the country. Section 4 of the Morrill Act defined how the states were to use the money generated by the sale of land as specified in the act. It specified that each state would use the money generated to endow and support at least one college, whose chief object would be “without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.”⁴¹ While this was fairly specific as to what type of education needed to be included, the law left enough ambiguity to provide a number of different interpretations as to how to implement it.

Throughout the country as land grant colleges were established, differences of opinion brought about various conceptions of what a land grant college could and should be. Farmers and educators differed in their conceptions of the where, the how, and the what of such schools. Some wanted new schools established while educators often favored adding on to existing institutions. How the curriculum should be organized and what should be included within the scope of the institutions being funded also garnered disagreements. Finding suitable instructors and constructing a collegiate-level curriculum could be difficult with no real scholarly literature

⁴⁰Ibid.

⁴¹Morrill Act from “Our Documents,” National Archives, <http://www.ourdocuments.gov/doc.php?doc=33&page=transcript>.

on the subject. Additionally, institutions would use the funds to help support teaching of all types—not just for agriculture and mechanic arts. While this was seen as being legal under the law, it was also viewed as not keeping the spirit of the law. Perhaps related to this was the fact that many students of the colleges did not go back to work on farms but often went into other professions. While agriculture education had difficulties at least initially with the Morrill Act, the mechanic arts, and by extension engineering, was more successful. Engineering education received a major boost from the Morrill Act, and engineering schools were more successful than agriculture schools.⁴² Out of this context came the University of California in 1868.

Start of the University of California

Not long before the Morrill Act had been passed and signed into law, the *Daily Alta* printed an editorial discussing the need for a state university. This February 1862 editorial noted that the state had put into its constitution a provision for a state university in anticipation of the federal government providing some funding for such a purpose. While no university had been founded in the past twelve years, the state Assembly had appointed a special committee to look into the issue, and several of the proposals to the committee were outlined in the newspaper's piece. Based on the dictionary definition of a university, the *Daily Alta* argued that the state Constitution required California to have a place of learning that was comparable "with the great European universities which are famed throughout the world, and are attended by students from every continent."⁴³ While not specifically arguing that a state university should be modeled on

⁴²Ibid., 23-33, 77.

⁴³"The State University of California," *Daily Alta* (San Francisco), February 23, 1862, 2. The newspaper specifically mentioned Paris, Berlin, Gottingen, and Munich as some of the great European universities.

the European universities, the newspaper did put the European institutions in a favorable light and spoke of the need to attract students that might otherwise look to Europe for an advanced education.

According to the *Daily Alta*, the university should be organized so that it would have “unsurpassed facilities for the acquisition of a master’s knowledge of every branch of physical science and the learned professions, and if possible, of the fine arts also.”⁴⁴ Science was at the top of the paper’s list of the type of knowledge students should be able to gain from a state university. Among the “learned professions,” the paper singled out medicine as being “one of the most important departments of the University.”⁴⁵ In the opinion, then, of a major newspaper, the physical sciences and medicine were two of the most important areas of study to be taught by a state university. However, in spite of the need for such an institution, the *Daily Alta* took the view that a state university should not be opened until enough funding was secured to operate it properly including supporting every department that would be needed. “If we cannot have a proper University, it were better to have none at all,” the *Daily Alta* opined. The paper took a pessimistic view that enough funding would not be found for another ten to fifteen years. Nonetheless, the state needed such “an institution of learning of the highest class” as not all young men who wanted to get a thorough education could be sent to the East Coast or Europe.⁴⁶ Thus, the paper concluded its editorial by stating that careful consideration of the matter made it clear that “a great University will be worth more to us than its pecuniary cost, and that it will

⁴⁴Ibid.

⁴⁵Ibid. Chapter 3 of this dissertation discusses how a medical school became part of the University of California.

⁴⁶Ibid.

secure to us, what we shall lose without it, the intellectual and educational headship of the States bordering on the Pacific.”⁴⁷ Fortunately for the *Daily Alta*’s editorial staff, California did not have to wait ten or more years to have a state university founded. Before the decade was out, the University of California would be established helping to secure the state’s intellectual and educational headship for the Pacific states.

In March 1868, John W. Dwinelle—an assemblyman from Alameda County—sponsored legislation to establish the University of California by acquiring the College of California. The Morrill Act finally allowed California to establish a state university, as the state now had the financial resources to support the operation of a school, although it still needed a location. Several site proposals had been made for the University of California. The one that the regents settled on was the site of the College of California in Oakland. This deal gave the state an already-built campus along with the property the College of California had recently purchased in Berkeley, which would become the permanent site of the University of California. The proposal had been made on behalf of the College of California by Henry Durant, the last president of the College of California (and the soon-to-be first president of the University of California). This proposal, while disincorporating the College of California and transferring its land and buildings to the University of California, also had the state assume all of the college’s debts along with its assets.⁴⁸

Even though the University of California was founded as a land grant college under the Morrill Act and had schools for agriculture and the mechanic arts, the university’s curriculum overall was fairly similar to eastern private colleges or to the University of Michigan—the leading

⁴⁷Ibid.

⁴⁸Hendrick, 243, 246.

western state university in the mid-1800s. These institutions emphasized a classical curriculum of Greek and Latin, mathematics, the natural sciences, morality, and philosophy.⁴⁹

Before the deal had been made with the College of California and as the University of California was still more of a conception than reality, the first regents of the institution called themselves the Board of Directors of the Agricultural, Mining, and Mechanical Arts College of the State of California. At their first meeting, they discussed the Morrill Act and how an educational institution would be funded through the federal legislation, and then they examined the state legislation that created the educational institution and set out the composition of the board. Two members of the board would be the president of the State Agricultural Society and the president of the Mechanics' Institute of San Francisco.⁵⁰ The Mechanics' Institute as a body and specifically presidents of the organization had long advocated for the creation of a state university, while agriculture in general throughout the country had been an important part of the Morrill Act and its implementation.

The first official board meeting for the new state university was held on June 20, 1866, in San Francisco. One of the first items of business was to create an advertising plan to solicit proposals for land sites where the school could be located. A few months later on September 7, the board again convened in San Francisco to evaluate the proposals that had been submitted. The first proposal came from Henry Durant of Oakland, offering property situated on a site like that of the College of California. Other proposals came from individuals in Sacramento, San

⁴⁹Ibid., 243-244.

⁵⁰*Record of the Minutes and Proceedings of the Board of Directors of The Agricultural, Mining, and Mechanical Arts College of the State of California*, 3-5, C00450 Loc. 3, California State Archives, Sacramento, CA.

Jose, El Dorado County, Santa Clara, Napa County, and Sutterville in Sacramento County.⁵¹

During the next few board meetings, the board continued to prepare for the opening of the school as well as to investigate the various possible locations. Finally, at the fifth board meeting on June 12, 1867, in Sacramento, the board was ready to vote on a site. On the third vote, the board selected Alameda County, where Oakland was located.⁵²

At the following board meeting on November 5, 1867, the minutes noted that a favorable report was received from the trustees of the College of California concerning a site. When the board met two days later, they accepted the offer of land donated from the College of California, which would be disincorporated. It was also at this meeting that the name of the state school was officially adopted as the University of California. Additionally, the board set out the colleges that the University of California would have. These included a College of Mines, a College of Civil Engineering, a College of Mechanics, a College of Agriculture, and an Academical College. The board stated that the institution should have courses at a level of instruction equal to that found in colleges in the Eastern United States.⁵³

The list of colleges within the University of California—not surprisingly for a school funded by and founded under the Morrill Act—was heavily focused on science and technology. Also of note was that while the state was less than two decades old, the board wanted to have the University of California be on par with the much longer established institutions in the East. This demonstrates that the board, while doing their duty of establishing an institution that met the requirements of the Morrill Act, also wanted to see that the University of California would be

⁵¹Ibid., 11-18.

⁵²Ibid., 24.

⁵³Ibid., 26-29.

equal nationally with colleges and universities that did not have science and technology as a founding emphasis.

Since the University of California had been founded under the Morrill Act with science and technology as a primary rationale, it was to be expected that these areas would have a main focus. As had been stated in the minutes from the organization of the university, there were four colleges that dealt with science and technology and one that focused on other subjects. The first were the “Colleges of Arts,” which consisted of the State Colleges of Agriculture, of Mechanic Arts, of Mines, and of Civil Engineering. This left “A State College of Letters” to round out the original five divisions of the University of California.⁵⁴ These five colleges were outlined in the *Circular of the University of California: Organization of the University*, which also gave the admissions requirements for prospective students. Besides knowing English grammar, geography, and United States history, students also needed to satisfactorily pass a test on “*Higher Arithmetic*, in all its branches, including the extraction of *square and cube roots* and the *metric system* of weights and measure, *Algebra to Quadratic Equations*, [and] *Geometry*.”⁵⁵ While scientific subjects were not part of the entrance requirements, a knowledge of mathematics was required to be demonstrated through an entrance exam. All students would, in general, take certain common curriculum and take more specialized classes based on the specific college they were in.

The *Circular*’s brief overview of the University of California was complemented with the *Prospectus of the University of California at Berkeley*, as it presented a more detailed description

⁵⁴University of California, *Circular of the University of California: Organization of the University* (Oakland: University of California, 1869 or 1870), 1, University Archives, The Bancroft Library, University of California, Berkeley.

⁵⁵*Ibid.*, 2 (italics in original).

of the founding and organization of the university. After going through the history of the Morrill Act and the offer and acceptance of the property of the College of California, the *Prospectus* quoted from the legislative act that created the University of California. Going beyond the closest reading of the Morrill Act, the University of California was “to provide instruction and complete education in all the departments of science, literature, art, industrial and professional pursuits, and general education, and also special courses of instruction for the professions of Agriculture, the Mechanic Arts, Mining, Military Science, Civil Engineering, Law, Medicine and Commerce.”⁵⁶ Each of the specialized technical areas was specifically mentioned, but what came first was the broader subjects of science (in general), literature, and art as well as other “pursuits” and general education. In spite of this seeming order of priorities, the actual establishment of colleges was in line with the intentions of the Morrill Act with the creation first of a College of Agriculture and a College of Mechanic Arts because, as the law stated, the Morrill Act had been passed with these specific subjects as the underlying rationale. The Board of Regents was thus charged with having the two colleges as “an especial object of their care and superintendence” with the agriculture and mechanic arts colleges receiving the primary financial benefit from the funds generated under the Morrill Act.⁵⁷ Next in line to be established were the College of Mines and the College of Engineering. The Board of Regents was also given the authority to create other Colleges of Arts as feasible and necessary. The College of Letters, teaching the classical subjects, came into being in large part through the transfer of the classically-oriented faculty and curriculum of the College of California. Finally, the Regents

⁵⁶University of California, *Prospectus of the University of California at Berkeley, Alameda County, California* (San Francisco: Excelsior Press, Bacon and Company, Printers, 1868), 20, University Archives, The Bancroft Library, University of California, Berkeley.

⁵⁷*Ibid.*, 21.

were given the authority to incorporate any medical or law college into the University of California.⁵⁸ This was done with medicine when the Toland Medical College became part of the University of California as discussed in a previous chapter.

Science at the University of California

With science and technology primary factors behind the Morrill Act and thus the creation of the University of California, the curriculum taught by the institution had a large focus on those subjects. Additionally, to support the scientific and technical classes, the University of California had several museums and collections of items relating to the various colleges and departments. These aided in instruction and also could provide opportunities for interactions with the public.

The *Register of the University of California* was the school's catalog that listed the professors and information about the university, including classes. The one from 1870 provides a glimpse of what was being taught in the university's second year. Across the Colleges of Arts, the first two years of science and mathematics classes were the same as well as much of the third and fourth years. Mathematics was part of the course of instruction for the first three years. Algebra and geometry were studied during the first year as well as trigonometry and mensuration, and in the second year, descriptive and analytical geometry were studied, while calculus was the area of mathematics done in the third year. During the first year, science subjects that were studied included physiology, hygiene, and natural history. In the second year, physics, chemistry, and botany were begun to be studied along with navigation and surveying,

⁵⁸Ibid., 21-23. Although there was not a military college, due to the stipulations of the Morrill Act, all able-bodied male students were to receive military instruction in addition to their regular classes.

mechanics, and zoology. A laboratory class was also part of the curriculum during the second year.⁵⁹ These mathematics and science classes formed the basis of knowledge that students in all of the arts colleges were expected to know.

In the third and fourth years, the science subjects varied somewhat by college. For the College of Agriculture, the subjects taught in the third year included chemistry, mechanics, physics, and zoology, along with geology, horticulture, and mineralogy. Students were taught agriculture, mental and moral philosophy, veterinary science, rural economy, political economy, animal and plant diseases, natural theology, and forestry and continued to study geology and physics all in the fourth year. Both the third and fourth years also included laboratory practice.⁶⁰ As might be expected for an agriculture college, a number of classes emphasized animals, plants, and other aspects of rural life. Such subjects had importance for a state that was mostly rural.

The College of Mechanic Arts included in its curriculum some of the same classes as in the College of Agriculture but had an emphasis on mechanical training. While geology, physics, and zoology were all taught in the third year as in the agriculture college, the mechanic arts college had students study mechanical drawing, the mechanics of machinery, and metallurgy. Likewise, in the fourth year both colleges included mental and moral philosophy, physics, geology, political economy, and natural theology, and additionally the College of Mechanic Arts' curriculum contained applied mechanics, civil engineering, astronomy, architectural drawing, and thermodynamics.⁶¹ Mechanical training, both in theory and practice, were

⁵⁹University of California, *Register of the University of California* (Oakland, CA: D. W. Gelwicks, State Printer, 1870), 33-35, University Archives, The Bancroft Library, University of California, Berkeley.

⁶⁰*Ibid.*, 35-36.

⁶¹*Ibid.*, 37-39.

important aspects of the course of study for the College of Mechanic Arts. These subjects were also useful in the still important mining industry.

The College of Mines' subjects were even more similar to those of the College of Mechanic Arts than the mechanic arts college was to the agriculture college. In the third year, the College of Mines had the same classes as the College of Mechanic Arts with the addition of a laboratory class and courses in mining, topographical surveying, mineralogy, and analytical chemistry. The same was true for the fourth year when the mine college added classes in assaying and mining engineering.⁶² The curriculum for the College of Mines had many of the same sort of classes as was seen in the curriculum of Santa Clara College, for instance, that had also emphasized mining and metallurgy as part of its curriculum, albeit a number of years earlier.

Mining was one area of California's developing political economy in which the University of California played a role. When the California legislature first began working on a bill to establish an institution under the Morrill Act, the institution was to be known as the "Agricultural and Mechanical Arts College." However, mining interests wanted to ensure that their needs would be addressed, so with their urging, the legislature changed the proposed name to the "Agricultural, Mining, and Mechanical Arts College." The bill also included a sentence stating that the school would emphasize how mechanical arts could be applied to agriculture and mining. After the University of California opened in 1868, it took several years before the university's first trained geologists and engineers graduated. When such individuals—along with those trained by schools in the eastern United States or Europe—entered the workforce, they

⁶²Ibid., 40-41.

collectively allowed California to have advancing technologies in mining, milling, and other related industries.⁶³

By the 1870s, the University of California with its mining school was already perceived as the leading institution for that profession in the western United States. While some miners had an engineering background, even those without such knowledge saw the benefits of learning at least basic knowledge of assaying, geology, and mineralogy. With the easily found gold of the early days of the Gold Rush gone, having some sort of technical training was seen as increasingly important to be a successful miner. Publications in the 1860s called for the establishment of a school in California that could teach the necessary mining knowledge. While the College of California in what would be its final years had tried to have a mining curriculum, the University of California was able to make such an education truly possible.⁶⁴ The College of Mines was the division within the University of California that provided that education.

Like the College of Mines, the College of Civil Engineering also had a similar curriculum to that of the College of Mechanic Arts. In the third year, students had laboratory time as well as taking classes in surveying (both “higher” and topographical), chart drawing, and mineralogy. In the fourth year, students studied surveying (this time geodetic), drawing (architectural, mechanical, and structural), principles of construction, mechanics of engineering, and civil engineering.⁶⁵ While it can be argued that the previous arts colleges were fairly similar

⁶³Ronald H. Limbaugh, “Making Old Tools Work Better: Pragmatic Adaptation and Innovation in Gold-Rush Technology” in *A Golden State: Mining and Economic Development in Gold Rush California*, ed. James J. Rawls and Richard J. Orsi, California History Sesquicentennial Series; 2 (Berkeley: University of California Press, 1999), 45.

⁶⁴Clark C. Spence, *Mining Engineers & the American West: The Lace-Boot Brigade, 1849-1933*, Yale Western Americana Series, 22 (New Haven, CT: Yale University Press, 1970), 24-25, 43-45.

⁶⁵*Register of the University of California* 1870, 42-43.

in scope to what had been taught at such institutions as Santa Clara College, St. Ignatius College, the College of California, or even the University of the Pacific, the University of California's College of Civil Engineering indicates a broadening of the type of skills necessary in California as the state entered its third decade. With state officials sitting on the Board of Regents, it would not be surprising that the school would have classes and programs that were directly in line with ambitions for the political economy of the state.

What may be more surprising is the similarity in the classes between the four Colleges of Arts and the College of Letters. Even for those students not taking a course of study that would prepare them for a scientific or technical career, they were expected to graduate from college with a broad scientific base of knowledge. For instance, in the first year, students studied algebra, geometry, trigonometry, mensuration, natural history, and physiology and hygiene. Subjects covered in the second year included geometry, botany, chemistry, physics, mechanics, zoology, and navigation and surveying as well as work in the laboratory. Mechanics, physics, and zoology were also covered in the third year, along with logic, calculus, and geology and also a laboratory class. Finally, in the fourth year, students concluded with physics, geology, and laboratory work and rounded out their college years with classes in mental and moral philosophy, astronomy, natural theology, and political economy.⁶⁶ While not taking the specialized courses that the students in the Colleges of Arts took, the students in the College of Letters received instruction in most of the same basic scientific and mathematical subjects. Science, then, was an important part of the general curriculum at the University of California. It was expected that students who received a diploma from California's state university would have

⁶⁶Ibid., 44-48.

a level of proficiency in mathematics and various scientific disciplines. Science was not to be left just to those formally studying scientific and technical subjects.

A laboratory course was often part of the classes, either required or optional, for students in various years of college. Demonstrations and laboratory skills were part of the teaching for several scientific subjects. For instance, in the physics and mechanics department, the instruction was done through lectures, recitations, solving problems, and the use of experimental demonstrations. Classes utilized the “Cabinet of Physical Apparatus,” which the department stated was “very complete” with additions to it being made yearly.⁶⁷ The geology and natural history department utilized microscopes to “illustrate” courses, or in other words to exemplify the material through real specimens.⁶⁸ Additionally, courses were “illustrated by the use of an ample museum of rocks, ores and fossils, and an extensive collection of . . . geological casts.”⁶⁹ These were the beginnings of the various collections that would continue to expand in the following years.

Like Santa Clara College about two decades earlier, the University of California invested a great deal of money to obtain scientific equipment from Europe and elsewhere. Even in just a few years, the University of California already possessed “excellent apparatus, recently procured from Europe, and valued at over \$30,000, for the use of the Physical, Chemical and other Scientific Departments.”⁷⁰ The scientific cabinet had specimens collected from throughout California. Unlike private schools and even the State Normal School that generally had to either

⁶⁷Ibid., 51.

⁶⁸Ibid., 52.

⁶⁹Ibid., 53.

⁷⁰Ibid., 63.

buy their own rocks and minerals or rely on private donations, the University of California had support from the state legislature directing the State Geological Survey to provide the school with sufficient materials for uses of the university.⁷¹ Having the backing of state entities and the funding from the Morrill Act enabled the University of California to have a more complete set of equipment and other materials than might be expected for a new institution.

With this support and the beginnings of various collections, the University of California could claim without exaggeration that in just its second year of existence it already offered “excellent facilities for a thorough education.”⁷² This “thorough” education was provided by “a full and competent Faculty of instruction, and costly and complete apparatus . . . without charge, to all of both sexes, who are qualified to profit by its advantages.”⁷³ This education included not only a classical curriculum but technical subjects as well. As the *Register* described it, individuals who wanted “to study some practical branch of learning—for example, metallurgy or agricultural chemistry—. . . [would] here find every facility for its prosecution.”⁷⁴ Scientific and technical education at the University of California was in a strong position from the first years of the school.

A couple of years later as the University of California was in its fourth year, the *Register* gave more specifics about the type of degrees offered and education that students would receive. Within the College of Letters, students received a classical curriculum including learning ancient and modern languages as well as instruction in mathematics and natural science. This course of

⁷¹Ibid.

⁷²Ibid., 64.

⁷³Ibid.

⁷⁴Ibid., 65.

study led to a bachelor of arts. Alternatively, students in the College of Letters could instead receive a bachelor of philosophy degree if they took courses in literature or more science classes instead of one or both of the ancient languages.⁷⁵ This bachelor of philosophy was similar in content to the bachelor of science that was offered at the University of the Pacific and for a time at Santa Clara College. This demonstrates the value that both the institutions and students placed on a college education based on the traditional classical curriculum but with a modern twist of having more science (or perhaps literature, as at the University of California) instead of ancient languages that in the latter half of the nineteenth century would not be as of much use to the up-and-coming man (or woman).

In the other colleges, which this *Register* termed the “Colleges of Science and the Arts, including Agriculture, Engineering, and Chemistry,” the degree offered was a bachelor of philosophy. For these programs, the curriculum was focused on science and mathematics. After introductory courses the first two years, students studied a specific curriculum depending on their course of study, such as agriculture, chemistry, or engineering, during the final two years. Mining and specialized types of engineering were planned to be offered on occasion. Additionally, if a student did not choose any of these areas, then the second two years would include selected scientific courses.⁷⁶ This allowed students to still obtain a scientific undergraduate education even if they were not wanting to become a chemist, engineer, or farmer.

Whatever the degree or specific course of study, students at the University of California were to receive a broad education. This meant that students were “required to obtain knowledge

⁷⁵University of California, *Register of the University of California: Department of Letters and Science, 1872-73* (Oakland, CA: n.p., 1873), 15, University Archives, The Bancroft Library, University of California, Berkeley.

⁷⁶Ibid.

of other subjects than those which distinctively pertain to their specialty; for example, all the students of language receive some instruction in science, and all the students in science some instruction in language.”⁷⁷ Such a curriculum indicated the importance that the leaders of the University of California placed on a well-rounded education. This was an education that viewed scientific subjects as integral to the learning of college students in the 1870s. As might also be expected from a state university, the University of California was concerned about the political economy of the state. The educational aim of the institution specifically stated what this was. The “object” of structuring the curriculum to have students learn some knowledge from fields outside of their primary discipline was “to provide *a liberal culture, adapted to the various callings of modern society.*”⁷⁸ In setting out the purpose of an undergraduate education in this way, the University of California recognized the role education played in society. Education, including that of scientific education which all students at the University of California would receive to one extent or another, was important in supporting the political economy. The political economy now needed individuals who had a deeper educational background than some grade school or high school learning. This required institutions such as the University of California to provide this type of education, and this education needed to include science.

One specific area discussed relating to the political economy of the state was that of agriculture. While there was a general statement and understanding that a college education would be beneficial to society, agriculture and agricultural chemistry courses, in particular, were singled out for their direct contribution to California’s economy. For agricultural studies, the instruction was not just through lectures but also through practical work with plants and various

⁷⁷Ibid.

⁷⁸Ibid. (italics in original).

agricultural processes, as California was viewed as being able to grow a wide range of crops as well as benefitting from forests. The goal of the agricultural curriculum was “to illustrate every capability of the State for special cultures, whether of forests, fruits, or field crops, and the most economical methods of production.”⁷⁹ The University of California’s purpose, at least in terms of agricultural studies, was to aid in producing a greater and more economically efficient agricultural harvest. To accomplish this, students and professors would be involved with testing “new plants and processes” with “the results made known to the public.”⁸⁰ This was done in part by publishing their findings in widely circulated journals. By having results shared with the public, the University of California was directly engaging with farmers and others in the agriculture business. Professors and students would engage with and sometimes contribute to publications that also circulated in the general public. In addition to various agricultural textbooks, other sources utilized included the official reports from the federal agricultural department, *Transactions of the California State Agricultural Society*, and various California horticultural and agricultural journals.⁸¹ Through reading and contributing to these journals, a dialogue was created between academia and the public.

The University of California also engaged with the general public in scientific and literary discussions, done under the sponsorship of the Mechanics’ Institute of San Francisco. Lectures were organized by the Mechanics’ Institute and presented by professors and the president of the University of California. These lectures were attended by three to four hundred

⁷⁹Ibid., 31.

⁸⁰Ibid.

⁸¹Ibid.

people, filling the lecture hall in San Francisco.⁸² The Mechanics' Institute had been active in advocating for the creation of a state university, and now with the organization's president a member of the Board of Regents a natural connection was developed between the two institutions. The Mechanics' Institute sought to educate a wide swath of the public that would not otherwise receive a college education, and professors from the University of California were able to help in this endeavor.

The Mechanics' Institute had wanted the state university to be located in San Francisco, and even after the University of California was established in Berkeley, presidents of the Mechanics' Institute continued to advocate for a San Francisco location. Nonetheless, in presidential addresses, A. S. Hallidie, a long-serving Mechanics' Institute president, reiterated support of a state university and how having colleges pertaining to civil engineering, mechanic arts, and mining was in line with the goals of the Mechanics' Institute. Additionally, since the University of California was free for students to attend, this filled a need that the Mechanics' Institute might otherwise have had to provide.⁸³ In contrast to not charging tuition at the University of California, the Mechanics' Institute did charge a nominal fee for its lectures, many of which were presented by the faculty of the University of California. For a series of fourteen lectures in 1873, attendees were charged \$1, which the Mechanics' Institute estimated could raise \$2,500 a year for a successful set of lectures.⁸⁴ A year later \$2 was charged for fifteen

⁸²Ibid., 25.

⁸³A. S. Hallidie, *Fourteenth Annual Address to the Mechanics' Institute* (San Francisco: Cubery & Co., 1870), 14-15, Mechanics' Institute Annual Reports 1870-1876, University Archives, The Bancroft Library, University of California, Berkeley.

⁸⁴A. S. Hallidie, *Seventeenth Annual Address and Report to the Mechanics' Institute* (San Francisco: B. F. Sterett, Printers, 1873), 4, Mechanics' Institute Annual Reports 1870-1876, University Archives, The Bancroft Library, University of California, Berkeley.

lectures, but attendance was not as great, possibly due to the doubling of the cost.⁸⁵ No matter the reason, the lectures continued to be offered by the Mechanics' Institute, generally with good attendance, and the University of California had another outlet for reaching and educating the California public.

Another discipline, like agriculture, that had direct applicability to society was engineering. Besides using the normal instructional methods of lectures, recitations, textbooks, and other reference sources, the engineering department made use of models. These included representations of arches, bridges, topography, and trusses, for example. Students also examined diagrams and photographs of well-known engineering structures from the United States and Europe.⁸⁶ This shows that the students were indeed engaging in “real-world” engineering problems by studying current structures in the Western world.

Besides the models and equipment already mentioned, the University of California continued to expand its collection of instructional resources. For instance, the geological collection was greatly increased by the acquisition of fossils, minerals, ores, and metallurgical products that had been donated to the University of California. Additionally, the California Geological Survey was providing its collections to the school. These new geological items were added to the series of Ward Geological Casts the school already had. The botany courses were enhanced through the beginnings of an herbarium. This initial collection was donated to the

⁸⁵A. S. Hallidie, *Eighteenth Annual Address and Report to the Mechanics' Institute* (San Francisco: Chas. W. Gordon, Book and Job Printer, 1874), 4, *Mechanics' Institute Annual Reports 1870-1876*, University Archives, The Bancroft Library, University of California, Berkeley.

⁸⁶*Register of the University of California 1872-73*, 34. The models, diagrams, and photographs had been obtained by the monetary donation of an Oakland resident. No indication is given of which structures or locations these examples were from.

University of California and consisted of about one thousand Australian plants. Unlike most of the other collections, the beginnings of the botany collection did not pertain specifically to California, but for a new institution perhaps some plants from another country were better than no plants at all. One other collection was for chemistry with additions being made during the first several years.⁸⁷ All of these collections and others enabled the University of California to provide the hands-on materials needed for practical instruction in scientific and technical fields. Through the use of collections, students could understand concepts more fully than from simply reading from a textbook or even listening to lectures from their professors. This enabled students to be better prepared for situations they would encounter and thus allowed the University of California to better equip its students to provide a positive effect upon California.

In the following few years, the collections continued to expand greatly, and the University of California could discuss its holdings more specifically. For instance, the 1874 *Register* listed in detail the equipment and uses of the chemical laboratories. These laboratories were part of the Agricultural College and used space on the first floor and in the basement. Quantitative analysis experiments were done on the first floor with room for thirty-two students at a time. The chemical cabinet, including all known chemical salts, was also housed on this floor. The basement was the location for qualitative analysis and inorganic chemistry experiments.⁸⁸ Besides the chemistry collections, the philosophical apparatus made up of the cabinet of physical and mechanical apparatus was also highlighted as being “very complete.”⁸⁹

⁸⁷Ibid., 38.

⁸⁸University of California, *Register of the University of California: Literary and Scientific Departments, 1874* (Berkeley, CA: no printer, 1874), 21-23, University Archives, The Bancroft Library, University of California, Berkeley.

⁸⁹Ibid., 23.

Some of the physical properties that the apparatus could illustrate included expansion, heat, elastic forces, motion, centrifugal force, gravity, and friction, among others. Pendulums and air pumps were also used, and equipment was itemized that dealt with electricity, sound, waves, and optics.⁹⁰ For the engineering department, surveying instruments comprised a “valuable collection.”⁹¹

In addition to the various collections and laboratory equipment, the University of California also increased the items in and scope of its museums. As mentioned, the geological museum included several collections. One was the state geological survey collection that had several components. California rock, mineral, and fossil specimens along with items to show California’s mining resources were part of the collection. The museum also had a collection of fossil casts, minerals, ores, shells, and other items as well as a natural history collection, although much of what had been in this collection had been lost when the boat the items were in had burned on their way to the Smithsonian Institute to be studied further.⁹² Other museums at the University of California included a museum of economic and systematic botany (for teaching botany classes) and a museum of ethnology (to “illustrate the characteristics of primitive men”).⁹³ These museums provided teaching opportunities for the students in the various science courses. Having different museums focused on different aspects of science and the continued efforts to increase the breadth and depth of the collections demonstrated the commitment to

⁹⁰Ibid., 23-24.

⁹¹Ibid., 24.

⁹²Ibid., 25-26. Fire also claimed a collection of California ores that had been stored in a San Francisco warehouse.

⁹³Ibid., 26. What men were considered primitive and contained in the collection is not specified.

science that the university had.⁹⁴

By the 1876-1877 academic year, the number of museums at the University of California had increased. Besides continuing to expand the collections in existing museums—such as the museums for botany, ethnology, and geology, a separate museum of mineralogy had been created, showcasing the large mineral collection from the western United States, as well as items from the eastern United States and Europe. Additionally, a museum of classical archaeology (featuring ancient coins and medals) and a museum of zoology (with a self-described “very small” collection) had also been established. Finally, while not a separate museum, the civil engineering department possessed a collection of surveying equipment.⁹⁵ Again, through the increase in the number of museums, the University of California exhibited a dedication to scientific endeavors.

One of the longest lasting scientific contributions made during this academic year was the founding of an observatory, later to be called the Lick Observatory in honor of James Lick who funded it. At the time, seven hundred thousand dollars had been designated for the construction of the building and the equipment.⁹⁶ Between the observatory and the various museums, the University of California had a strong basis for scientific instruction in terms at least of equipment and physical objects. Obviously, having the right professors was of great importance as well, but structurally, the institution had done what it could to set itself up for scientific study.

⁹⁴The University of California actively sought contributions to the museums and had arranged with Wells, Fargo & Co. to transport the items at no cost to Berkeley. *Ibid.*, 27.

⁹⁵University of California, *Register of the University of California: Literary and Scientific Departments, 1876-7* (Berkeley, CA: no printer, 1876), 31-33, University Archives, The Bancroft Library, University of California, Berkeley.

⁹⁶*Ibid.*, 30. The observatory was located on Mount Hamilton in Santa Clara County.

Conclusion

Three decades after statehood, California had a more than ten-year-old state university to complement the other institutions of higher education, some of which had been present almost since statehood. A state university had been discussed and attempted beginning with the California Constitutional Convention, but it would literally take an act of the United States Congress—the Morrill Act in this case—to bring the university into existence. Between the Constitutional Convention in 1849 and the opening of the University of California in 1868, private institutions, like the College of California, filled the educational gap in the state.

The College of California, begun in 1855, functioned much like the other private colleges in the state. It, along with Santa Clara College, St. Ignatius College, and the University of the Pacific, was an educational institution founded by religious leaders interested in education and the welfare of the citizens of California. Undoubtedly, religious and evangelistic motivations had brought many of these religious leaders to the state, but once here they turned to seemingly more earthly aspects of life in California. Samuel Willey, one of these religious leaders, had brought higher education and the concept of a state university to the delegates at the constitutional convention. Like those in the Jesuit and Methodist communities, members of the Congregationalist and Presbyterian denominations rallied to support a college. Additionally, the College of California, similar to the colleges in Santa Clara and San Francisco, worked to modify its offerings to provide a type of education useful to the changing needs of the political economy.

When the University of California was finally opened in 1868, it joined another state institution of higher education, the California State Normal School. Both of these institutions were operated by the state. While each had quite different educational courses of study, both

were charged with educating the people of California. One—the California State Normal School—educated individuals who would become teachers in the common schools and thus bring education to a wide swath of the youngest Californians, the other—the University of California—educated individuals who could go on directly to become leaders in society. These individuals would often be the ones with degrees in the scientific and technical areas of instruction.

This was the view, certainly, of alumni of the University of California, even in its first years. While they would have some biases toward supporting their alma mater, in an 1878 report a committee of alumni noted what they believed to be the benefit of an education from the University of California. Claiming that no “idlers” existed among the graduates, they stated that many of these graduates were engaged in work related to the political economy of the state in enterprises that were continuing to build up the infrastructure and prosperity of California. They stated that individuals were working as railroad engineers as well as being employed in mining, surveying, mills, machine shops, and agriculture. As an example, they provided an anecdote of a graduate from the College of Agriculture that had produced a crop worth \$12,000 during the previous year, which had been dry, while his neighbors had difficulty in covering their expenses. The conclusion of this was that “University instruction *pays*.”⁹⁷ Coming from alumni, this conclusion obviously must be taken with a fair amount of skepticism and with knowledge that there is little way of conclusively substantiating their claims. Nonetheless, it provides an insight into how students and alumni (and California citizens) viewed the state university and its role in

⁹⁷“Report of a Committee from the University Alumni Association of the University of California” (Oakland, CA: Daily Evening Tribune Book and Job Printing House, 1878), 15, University of California, Berkeley–Alumni Association folder, California Historical Society Archives, San Francisco, CA (*italics in original*).

society.

This role provided the state with the university that had been enshrined in its constitution and went beyond what the private colleges had been able to offer previously. The private colleges relied on religious support and tuition to keep their doors open, and sometimes (as with the College of California) that was not enough. The University of California, on the other hand, did not need to charge tuition and had the funding from the Morrill Act to support its operations. Even more than the state-sponsored California State Normal School, the University of California had the backing of state entities to help in getting the university fully operational and with a sizeable collection of equipment and specimens. Along with the assistance from the acquisition of the College of California, the University of California was able to quickly provide an education that was far wider in scope than its predecessors in the state. The University of California also had the advantage of being founded 18 years after statehood and thus in a more mature state with many of the systems and institutions in place that could aid in its success.

The College of California and the University of California were two different institutions, albeit with the same faculty and campus at the end of one and the beginning of the other. Both took up the role of providing science education in California. Seeking to meet the needs of the political economy, science was an important part of this endeavor. The College of California's entrepreneurial (and not very successful) attempt gave way to the structured and systematic science and technical education that the University of California offered. The ultimate success of the University of California can be attributed to a number of factors, from the Morrill Act to the experiences of the colleges that came before. The University of California would have difficulties as it grew, but science education, and higher education in general, was on a stronger footing in the state of California.

Conclusion

When California entered the Union as the thirty-first state in 1850, it did so as waves of immigrants flocked to the state in an effort to capitalize on the Gold Rush of 1849. Out of the Gold Rush, California became a state, and mining was an essential aspect of the California economy in the first years of statehood helping to fuel the state's growth. Soon agriculture became more important as diversification of the economy increased. As the population also continued to increase and more women and families settled in the state, infrastructure developed to meet the growing populace's needs. The state government played a role in this, including with education. Education had been discussed at the 1849 California Constitutional Convention and included in the state's constitution. While some aspects of the education clauses took some time to be fulfilled—most prominently the creation of a state university, education had a notable place in the state from the start. Schools of all levels were founded, with various religious groups establishing higher educational institutions. The state provided official recognition of these schools, but it was up to the school's leaders to find a way to attract enough students to keep the doors open. Along with education, other aspects of California's political economy also developed, such as healthcare with the establishment of hospitals, pharmacies, and medical schools. These aspects of the political economy came together in various ways in California's first colleges. As this dissertation has demonstrated, these colleges, through their science education, interacted in important ways with the political economy of the new state.

California's political economy evolved from what it had been pre-statehood and continued to develop as the state grew in the first decades post-statehood, as described in chapter 1. While California had been economically active since Spanish colonization, with the Gold Rush, California's economic activity reached new heights. Also, becoming a state in the Union

further changed the political economy from what it had been previously under Mexican rule. A broad range of activities contributed to the development of the state. For instance, mining and trade were important parts of the political economy in the years leading up to statehood and through the 1850s. Agriculture became increasingly important in the 1860s and 1870s. Institutions and infrastructure were created and developed as the population increased and differing needs were presented. The state constitution and the legislature set up offices and procedures that outlined how California government and society would operate. The state government chartered institutions of higher education and oversaw pre-collegiate education. State agencies were involved with the establishment of healthcare and financial institutions. Private individuals and organizations also became involved with the state's political economy as they lobbied for various ideas and goals.

The first colleges worked to engage the state's political economy, among other goals for the schools. The founders and leaders of the institutions stated—in public addresses and in writings—that their schools were needed for California to continue developing as a state. Through both words and deeds, the schools rendered practical training in areas such as mining, agriculture, and medicine, and they defended the type of education they provided. Generally, these colleges aimed at modeling themselves after colleges and universities in the eastern United States and in Europe. Several of the first colleges were religiously affiliated and drew upon their intellectual and educational traditions in the operation of the institutions. Chapter 1 discussed some of the educational reforms that had taken place in the nineteenth century as well as the role religion played in the establishment of colleges.

Each school responded to the demands of the political economy in various and unique ways. Each sought to contribute to the state's political economy and also to make themselves

attractive to prospective students. The schools offered different courses of study, such as removing the study of classical languages and having a greater emphasis on scientific subjects, and awarded a bachelor of science degree in addition to the bachelor of arts degree. Institutions positioned science education to connect with the political economy. This connection came in printed materials and through the curriculum as science and technology were presented and taught in such a way indicating their importance and relevance.

Santa Clara College, one of the first two California colleges, regularly highlighted its scientific apparatus in descriptions of the college, as chapter 2 described. One of its founders wrote about agriculture in California, while Joseph Neri, a professor who taught at both Santa Clara College and its sister institution, St. Ignatius College, did important work with mining and electricity. Chapter 2 showed the extent to which these two Jesuit colleges took their scientific offerings seriously and how through donations and their own coffers worked to ensure that they had the latest in scientific equipment.

Situated in the same town as Santa Clara College, the University of the Pacific distinguished itself by not only being the other of the first two California colleges but, as outlined in chapter 3, by also offering educational opportunities to women, including teaching them the same subjects as were taught to men. While the University of the Pacific could not boast of the same level of scientific equipment as at Santa Clara College, it offered a bachelor of science degree when Santa Clara College did not. Additionally, north in San Francisco, a medical department under the University of the Pacific was established, providing the first doctors in California to have received a medical degree from an institution within the state. Chapter 3 related how, along with the Toland Medical College, the University of the Pacific's medical department started medical education in California.

Teaching a very different set of students than future medical doctors was the California State Normal School, discussed in chapter 4. Starting from educational reforms—common schools, normal schools, and teachers’ institutes—the normal school provided training for future teachers of California’s children. The science taught in this school was not as advanced as was found in the other colleges, but the reach of the science education was widespread as the graduates of the California State Normal School would fill positions in classrooms across the state.

The other state institution of higher education was the University of California. With the impetus of the federal Morrill Act to finally help California fulfill the educational promise outlined in the state constitution, the University of California, through the resources of the state along with the money provided by the Morrill Act, brought about a state university that emphasized science and technology. Chapter 5 described that while certainly this would be expected with the requirements of the Morrill Act, also useful to the developing economy of California was having a state institution that could train individuals in fields like engineering, agriculture, mining, and mechanic arts. Initially helped by the College of California’s buildings and professors, the University of California took shape as an institution that had a science and technological education along with offering a classical curricular education. Even for those students not in one of the applied science schools, students at the University of California received an education that included much scientific instruction.

Throughout, then, the first three decades of California statehood, colleges engaged with the economic and infrastructure development of the state. The colleges adapted to the changing needs of California. Professors, students, and alumni contributed to making California prosperous. As this dissertation has demonstrated, early California colleges promoted the state’s

political economy, broadly defined. The colleges related to the political economy in different ways, depending on their educational traditions and the current needs of that time and place. Keeping a sufficient enrollment to allow continued operation of the school was an important factor in how the colleges developed their curriculum and what aspects of the school they highlighted. This can be seen throughout the various institutions discussed in this dissertation. In the 1850s, the beginning of the period in this dissertation, small religious colleges were founded to educate students. Santa Clara College, the University of the Pacific, St. Ignatius College, and the College of California each had science education that interacted with the political economy of California. As the state grew and more educated teachers were needed, the California State Normal School began to fill this need. By the end of this period in 1880, the University of California was well established and provided an educational culmination to the first three decades of California as a state. California's educational trajectory would continue to evolve in the coming decades, but it began with these institutions and the science education they provided.

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