

# History of science and technology in the phillippines

[Science](#)



## A HISTORY OF SCIENCE AND TECHNOLOGY IN THE PHILIPPINES\* by Olivia C.

Caoili\*\* Introduction The need to develop a country's science

and technology has generally been recognized as one of the imperatives of socioeconomic progress in the contemporary world. This has become a widespread concern of governments especially since the post world war II years. (1) Among Third World countries, an important dimension of this concern is the problem of dependence in science and technology as this is closely tied up with the integrity of their political sovereignty and economic self-reliance.

There exists a continuing imbalance between scientific and technological development among contemporary states with 98 per cent of all research and development facilities located in developed countries and almost wholly concerned with the latter's problems. (2) Dependence or autonomy in science and technology has been a salient issue in conferences sponsored by the United Nations. (3) \_\_\_\_\_ Paper prepared for the University of the Philippines Science Research Foundation in connection with its project on " Analysis of Conditions for National Scientific and Technological Self-Reliance: The Philippine Situation," June 1986. \*\*Associate Professor, Department of Political Science, College of Social Sciences and Philosophy. University of the Philippines in Diliman, Quezon City. (1) For a brief summary of the evolution of government concern for the development of science and technology, see Olivia C. Caoili, Dimensions of Science Policy and National Development: The Philippine Experience, Monograph Series No. 1 (College, Laguna: Center for Policy and Development Studies, University of the Philippines at Los Banos, October 1982), pp. 4-34. (2) Guy B. Gresford

and Bertrand H. Chatel, " Science and Technology in the United Nations," World Development, Vol. II No. 1 (January 1974), p. 44. 3) See, for example, UNESCO, Science and Technology in Asian Development: Conference and Application of Science and Technology to the Development of Asia, New Delhi, August 1968 (Paris: UNESCO, 1970); United Nations Conference on Science and Technology for Development, Vienna, Austria, 1979, in Nature, Vol. 280 (16 August 1979), pp. 525-532. It is within the above context that this paper attempts to examine the history of science and technology in the Philippines.

Rather than focusing simply on a straight chronology of events, it seeks to interpret and analyze the interdependent effects of geography, colonial trade, economic and educational policies and socio-cultural factors in shaping the evolution of present Philippine science and technology. As used in this paper, science is concerned with the systematic understanding and explanation of the laws of nature. Scientific activity centers on research, the end result of which is the discovery or production of new knowledge. 4) This new knowledge may or may not have any direct or immediate application. In comparison, technology has often been understood as the " systematic knowledge of the industrial arts. "(5) As this knowledge was implemented by means of techniques, technology has become commonly taken to mean both the knowledge and the means of its utilization, that is, " a body, of knowledge about techniques. "(6) Modern technology also involves systematic research but its outcome is more concrete than science, i. e. the production of " a thing, a chemical, a process, something to be bought and sold. (7) In the past, science and technology developed separately, with the

latter being largely a product of trial and error in response to a particular human need. In modern times, however, the progress of science and technology have become intimately linked together. Many scientific discoveries have been facilitated by the development of new technology. New scientific knowledge in turn has often led to further refinement of existing technology or the invention of entirely new ones.

\_\_\_\_\_ (4) Jerome R. Ravetz, *Scientific knowledge and Its Social Problems* (Oxford: Clarendon Press, 1971), chap. ; James B. Conant, *Science and Common Sense* (New Haven and London: Yale University Press, 1974), chap. 2; Bernard Dixon, *What is Science For?* (New York: Harper and Row, 1973), chap. 2; David Knight, *The Nature of Science: The History of Science in Western Culture Since 1600* (London: Andre Deutsch, 1976), chaps. 1-2. (5) E. Layton, " Conditions of Technological Development," in Ina Spiegel-Rosing and Derek de Solla Price, eds. , *Science, Technology and Society, A Cross-Disciplinary Perspective* (London and Beverly Hills: Sage Publications, 1977), p. 199. (6) C. Freeman, " Economics of Research and Development. in Rosing and Price, *ibid.* , p. 235. (7) Derek de Solla Price, *Science Since Babylon* (Enlarged ed. ; New Haven: Yale University Press, 1975), p. 125. Precolonial Science and Technology There is a very little reliable written information about Philippine society, culture and technology before the arrival of the Spaniards in 1521. (8) As such, one has to reconstruct a picture of this past using contemporary archaeological findings, accounts by early traders and foreign travelers, and the narratives about conditions in the archipelago which were written by the first Spanish missionaries and colonial officials.

According to these sources, there were numerous, scattered, thriving, relatively self-sufficient and autonomous communities long before the Spaniards arrived. The early Filipinos had attained a generally simple level of technological development, compared with those of the Chinese and Japanese, but this was sufficient for their needs at that period of time. Archaeological findings indicate that modern men (*homo sapiens*) from the Asian mainland first came over-land and across narrow channels to live in Palawan and Batangas around 50, 000 years ago.

For about 40, 000 years, they made simple tools or weapons of stone flakes but eventually developed techniques for sawing, drilling and polishing hard stones. These Stone Age inhabitants, subsequently formed settlements in the major Philippine islands such as Sulu, Mindanao (Zamboanga, and Davao), Negros, Samar, Luzon (Batangas, Laguna, Rizal, Bulacan and the Cagayan region). By about 3, 000 B. C. , they were producing adzes ornaments of seashells and pottery of various designs.

The manufacture of pottery subsequently became well developed and flourished for about 2, 000 years until it came into competition with imported Chinese porcelain. Thus over time pottery making declined. What has survived of this ancient technology is the lowest level, i. e. , the present manufacture of the ordinary cooking pot among several local communities.

(9) Gradually, the early Filipinos learned to make metal tools and implements -- copper, gold, bronze and, later, iron. The iron age is considered to have lasted from the second or third century B. C. o the tenth century A. D. Excavations of Philippine graves and work sites have yielded iron slags.

These suggest \_\_\_\_\_ (8) William Henry Scott in Prehipic Source

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Materials for the Study of Philippine History (Rev. ed. ; Quezon City: New Day Publishers, 1984), asserts that there are only two authentic medieval Chinese accounts about prehipic Philippines. He points out questionable documents which have been the basis for information about this period and which were popularized in Philippines History textbooks, including theories that have been mistaken for facts.

Cf. Otley Beyer, " The Philippines before Magellan," and Robert B. Fox, " The Philippines in Prehistoric Times," in readings in Philippine Prehistory (Manila: Filipiniana Book Guild, 1979), Second Series, Vol. I, pp. 8-34; 35-61. (9) Scott, op. cit. , pp. 20-22. that Filipinos during this period engaged in the actual extraction of iron from ore, smelting and refining. But it appears that the iron industry, like the manufacture of pottery, did not survive the competition with imported cast iron from Sarawak and much later, from China. (10) By the first century A. D. Filipinos were weaving cotton, smelting iron, making pottery and glass ornaments and were also engaged in agriculture. Lowland rice was cultivated in diked fields, and in the interior mountain regions as in the Cordillera, in terraced fields which utilized spring water. (11) Filipinos had also learned to build boats for the coastal trade. By the tenth century A. D. , this had become a highly developed technology. In fact, the early Spanish chroniclers took note of the refined plank-built warship called caracoa. These boats were well suited for inter-island trade raids.

The Spaniards later utilized Filipino expertise in boat-building and seamanship to fight the raiding Dutch, Portuguese, Muslims and the Chinese pirate Limahong as well as to build and man the galleons that sailed to Mexico. (12) By the tenth century A. D. , the inhabitants of Butuan were

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trading with Champa (Vietnam); those of Ma-i (Mindoro) with China. Chinese records which have now been translated contain a lot of references to the Philippines. These indicate that regular trade relations between the two countries had been well established during the tenth to the fifteenth centuries.

Archaeological findings (in various parts of the archipelago) of Chinese porcelains made during this period support this contention. From the Sung (960-1278) and Yuan (1260-1368) Dynasties, there are descriptions of trade with the Philippines, and from the Sung and Ming (1360-1644) Dynasties there are notices of Filipino missions to Peking. (13) \_\_\_\_\_ (10) Ibid. , pp. 18-19. (11) Ibid. , pp. 136-137; Fox. op. cit. , pp. 49-50. (12) Antonio de Morga, *Sucesos de las Islas Filipinas*, first published in 1609, trans. and ed. by J. S. Cummins (Cambridge: Published for the Hakluyt Society at Cambridge University Press, 1971), pp. 252-253; Francisco Colin, *Labor Evangelica* (1663) in Horacio de la Costa, S. J. , *Readings in Philippine History* (Manila: Bookmark, 1965), p. 9; William Henry Scott, " Boat-Building and Seamanship in Classic Philippine Society," in *Cracks in the Parchment Curtain and Other Essays in Philippine History* (Quezon City: New Day Publishers, 1982), pp. 60-96. (13) See Scott, *Prehipic Source Materials...* , chap. ; Berthold Laufer, " The Relations of the Chinese to the Philippines," in *Readings in Philippine Prehistory*, pp. 142-177; Austin Craig, " A Thousand Years of Philippine History Before the Coming of the Spaniards," in *ibid.* , pp. 128-141. The most frequently cited Chinese account in Philippine history textbooks is that of Chao Ju-Kua in 1225. He described the communities and trading activities in the islands of Ma-i (Mindoro) and San-hsu (literally three

islands which present-day historians think refer to the group of Palawan and Calamian Islands). 14) The people of Ma-i and San-hsu traded beeswax, cotton, true pearls, tortoise shell, medicinal betelnuts, yu-ta cloth (probably jute or ramie? ) and coconut heart mats for Chinese porcelain, iron pots, lead fishnet sinkers, colored glass beads, iron needles and tin. These were practically the same commodities of trade between the islands and China which the first Spanish colonial officials recorded when they came to the Philippines more than two centuries later. (15) The Filipinos in Mindanao and Sulu traded with Borneo, Malacca and parts of the Malay peninsula.

This trade seems to have antedated those with the Chinese. By the time the Spaniards reached the archipelago, these trade relations had been firmly established such that the alliance between the rulers of Manila and Brunei had become strengthened by marriage. It was through these contacts that Hindu-Buddhist, Malay-Sanskrit and Arab-Muslim Cultural and technological influences spread to the Philippines. There have also been some references (by early travelers during the precolonial period) to trade relations between Japan and the Philippines.

To date however, Philippine historians have not found any prehipic references to the Philippines in Japanese literature of the period. (16)

\_\_\_\_\_ (14) Chao Ju-Kua was a Superintendent of maritime Trade in Ch'uanchow, Fukien province, when he wrote his *Chu Fan Chih* (An Account of the Various Barbarians) in 1225. Scott, in *Prehipic Source Materials...* pp. 66-70 has a translation of this account. See also " Chao Ju-Kua's description of the Philippines in the Thirteenth Century," in *Readings in Philippine Prehistory*, pp. 94-196; de la Costa, *op. cit.* , pp. 9-11. (15) See <https://assignbuster.com/history-of-science-and-technology-in-the-phillippines/>



Antonio Pigafetta, *First Voyage Around the World* and Maximilianus Transylvanus, *De Maluccis Insulis* (Manila: Filipiniana Book Guild, 1969), passim; excerpts of accounts by Garcia Escalante de Alvarado in 1548 and Rodrigo de Espinosa in 1564, in de la Costa, op. cit. , pp. 12-13; "Relation of the Voyage to Luzon," (1570) in *The Colonization and Conquest of the Philippines by Spain, Some contemporary Source Documents, 1559-1577* (Manila: Filipiniana Book Guild, 1965), pp. 160-178. 16) Antonio M. Regidor y Jurado and J. Warren T. Mason (in *Commercial Progress in the Philippine Islands*, published in London, 1905, and reprinted in Manila by the American Chamber of Commerce of the Philippine Islands, 1925, pp. 8-11), claim that the Japanese not only traded and lived in different parts of the Philippines before the Spaniards arrived, they also taught the Filipinos the art of working in metals, weaving, gold-mining, furniture making, duck-raising and fish-breeding for export. Scott (in *Prehipic Source Materials...* pp. 78-79) doubts the authenticity of these reports as research on Japanese literature during this period has yielded no references to prehipic Philippines. By the time the Spaniards came to colonies the Philippines in 1565, they found many scattered, autonomous village communities (called barangays) all over the archipelago. These were kinship groups or social units rather than political units. They were essentially subsistence economies producing mainly what they needed. These communities exhibited uneven technological development.

Settlements along the coastal areas which had been exposed to foreign trade and cultural contacts such as Manila, Mindoro, Cebu, Southern Mindanao and Sulu, seem to have attained a more sophisticated technology.

In 1570, for example, the Spaniards found the town of Mindoro " fortified by a stone wall over fourteen feet thick," and defended by armed Moros -- " bowmen, lancers, and some gunners, linstocks in hand. " There were a " large number of culverins" all along the hillside of the town. They found Manila similarly defended by a palisade along its front with pieces of artillery at its gate.

The house of Raja Soliman (which was burned down by Spaniards) reportedly contained valuable articles of trade -- " money, copper, iron, porcelain, blankets, wax, cotton and wooden vats full of brandy. " Next to his house was a storehouse which contained: much iron and copper; as well as culverins and cannons which had melted. Some small and large cannon had just begun. There were the clay and wax moulds, the largest of which was for a cannon seventeen feet long, resembling a culverin... (17) These reports indicate that the Filipinos in Manila had learned to make and use modern artillery.

The Spanish colonizers noted that all over the islands, Filipinos were growing rice, vegetables and cotton; raising swine, goats and fowls; making wine, vinegar and salt; weaving cloth and producing beeswax and honey. The Filipinos were also mining gold in such places as Panay, Mindoro and Bicol. They wore colorful clothes, made their own gold jewelry and even filled their teeth with gold. Their houses were made of wood or bamboo and nipa. They had their own system of writing,(18) and weights and measures. Some communities had become renowned for their plank-built boats.

They had no calendar but counted the years by moons and from one harvest to another. In the interior and mountain settlements, many Filipinos were still  
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living as hunters. They gathered forest products to trade with the lowland and coastal settlements. But they also made \_\_\_\_\_ (17) "Relation of the Voyage to Luzon," (1570), op. cit. , pp. 163, 176-177. (18) Scott, Prehipic Source Materials. pp. 52-62. \_ " iron lance-points, daggers and certain small tools used in transplanting. "(19) On the whole, the pre-colonial Filipinos were still highly superstitious.

The Spaniards found no temples or places of worship. Although the Filipinos knew how to read and write in their own system, this was mainly used for messages and letters. They seem not to have developed a written literary tradition at that time. (20) This would have led to a more systematic accumulation and dissemination of knowledge, a condition that is necessary for the development of science and technology. Because of the abundance of natural resources, a benign environment and generally sparse population, there seemed to have been little pressure for invention and innovation among the early Filipinos.

As governor Francisco de Sande observed in 1575, the Filipinos do not understand any kind of work, unless it be to do something actually necessary -- such as to build their houses, which are made of stakes after their fashion; to fish, according to their method; to row, and perform the duties of sailors; and to cultivate the land... (21) Developments in Science and Technology During the Spanish Regime The beginnings of modern science and technology in the Philippines can be traced to the Spanish regime.

The Spaniards established schools, hospitals and started scientific research and these had important consequences for the rise of the country's professions. But the direction and pace of development of science and <https://assignbuster.com/history-of-science-and-technology-in-the-phillippines/>

technology were greatly shaped by the role of the religious orders in the conquest and colonization of the archipelago and by economic and trade adopted by the colonial government. \_\_\_\_\_ (19) " Relation of Conquest of the Island of Luzon," (1572) and " Relation of the Filipino Islands, by Francisco de Sande. (1575), in *The Colonization and Conquest of the Philippines by Spain. op. cit. , pp. 190-210; 292-33;* " Relation of the Philippine Islands by Miguel de Loarca," (1575) and " Customs of the Tagalogs by Juan de Plascencia," in *Readings in Philippine Prehistory*, pp. 197-220; 221-234. (20) The Code of Kalantiao and Maragtas Code which have been taught by historians as precious prehipic documents were recently shown to have been fabricated much later. See Scott, *Prehipic Source Materials*, Chaps. 4-5. (21) " Relation of the Filipino Islands, by Francisco de Sande," (1575), *op. it. , p. 313*. The interaction of these forces and the resulting socio-economic and political changes must, therefore, be analyzed in presenting a history of science and technology in the Philippines. Spanish conquest and the colonization of the archipelago was greatly facilitated by the adoption of an essentially religious strategy which had earlier been successfully used in Latin America. Known as *reduccion*, it required the consolidation of the far-flung, scattered *barangay* communities into fewer, larger and more compact settlements within the hearing distance of the church bells.

This was a necessary response to the initial shortage of Spanish missionaries in the Philippines. This policy was carried out by a combination of religious conversion and military force. The net result of *reduccion* was the creation of towns and the foundation of the present system of local government. The

precolonial ruling class, the *datus* and their hereditary successors, were adopted by the Spanish colonial government into this new system to serve as the heads of the lowest level of local government; i. e. as *cabezas de barangay*.

The colonial authorities found the new set-up expeditious for establishing centralized political control over the archipelago -- for the imposition and collection of the tribute tax, enforcement of compulsory labor services among the native Filipinos, and implementation of the compulsory sale of local products to the government. The Filipinos naturally resisted *reduccion* as it took them away from their rice fields, the streams and the forests which were their traditional sources of livelihood and also subjected them to the onerous economic exactions by the colonial government.

Thus the first century of Spanish rule brought about serious socio-economic dislocation and a decline in agricultural production and traditional crafts in many places. In the region surrounding the walled city of Manila, Filipinos migrated from their *barangays* to the city in order to serve in the convents and thus avoid the compulsory labor services in the shipyards and forests. (22) Over the centuries, this population movement would greatly contribute to the congestion of Manila and its suburbs.

The religious orders likewise played a major role in the establishment of the colonial educational system in the Philippines. They also influenced the development of technology and promotion of scientific research. hence, these roles must next be examined. ----- (22) On the consequences of *reduccion*, tributes and forced labor services, see John Leddy Phelan, *The*

Hipization of the Philippines, Spanish Aims and Filipino Responses, 1565-1700 (Madison: The Univesity of Wisconsin, 1959), chaps.

IV, VII-IX; Nicholas P. Cushner, S. J. , Spain in the Philippines; from Conquest to Revolution (Quezon City: Ateneo de Manila University, Institute of Philippine Culture, 1971), chaps. 4-5; de la Costa, op. cit. , pp. 35-37. Various decrees were issued in Spain calling for the establishment of a school system in the colony but these were not effectively carried out. (23) Primary instruction during the Spanish regime was generally taken care of by the missionaries and parish priests in the villages and towns.

Owing to the dearth of qualified teachers, textbooks and other instructional materials, primary instruction was mainly religious education. Higher education was provided by schools set up by the different religious orders in the urban centers, most of them in Manila. For example, the Jesuits founded in Cebu City the Colegio de San Ildefonso (1595) and in Manila, the Colegio de San Ignacio (1595), the Colegio de San Jose (1601) and the Ateneo de Manila (1859). The Dominicans had the Colegio de San Juan de Letran (1640) in Manila. (24) Access to these schools was, however, limited to the elite of the colonial society -- the European-born and local Spaniards, the mestizos and a few native Filipinos. Courses leading to the B. A. degree, Bachiller en Artes, were given which by the nineteenth century included science subjects such as physics, chemistry, natural history and mathematics. (25) On the whole, however, higher education was pursued for the priesthood or for clerical positions in the colonial administration.

It was only during the latter part of the nineteenth century that technical/vocational schools were established by the Spaniards. (26) <https://assignbuster.com/history-of-science-and-technology-in-the-phillippines/>

----- (23) Henry Frederick Fox, " Primary Education in the Philippines, 1565-1862," *Philippine Studies*, Vol. 13 (1965), pp. 207-231, Encarnacion Alzona, *A History of Education in the Philippines, 1565-1930* (1st ed. ; Manila: University of the Philippines Press, 1932), pp. 20-23, 46-52; Eliodoro G. Robles, *The Philippines in the Nineteenth Century* (Quezon City: Malaya Books Inc. 1969), pp. 219-229; J. Mallat, " Educational Institutions and Conditions," (1846), in Emma H. Blair and James Alexander Robertson, *The Philippine Islands 1493-1898* (Cleveland, Ohio: The Arthur H. Clark Co. , 1906), Vol. XLV, pp. 263-278. (24) The Colegio de San Ildefonso grew to become the present University of San Carlos in Cebu City. It was taken over by the Society of the Divine Word in 1933 and continues to be administered by this Order. The Colegio de San Ignacio prospered and was elevated to the rank of a royal and pontifical university in 1621.

It was closed when the Jesuits were expelled from the Philippines on 17 May 1768 by a royal decree of Charles III. The Colegio de San Jose was seized by the Crown upon the expulsion of the jesuits and later became the medical and pharmacy departments of the University of Santo Tomas. The Ateneo de manila is now a University run by the Jesuits. Alzona, *op. cit.* , pp. 24-29; Blair and Robertson, *op. cit.* , Vol. XLV, pp. 101-140. (25) The B. A. then was more equivalent to the present high school diploma. 26) The first school of arts and trades was founded in the province of Pampanga and a school of agriculture was opened in Manila in 1889. See Alzon, *op. cit.* , pp. 43-46; 156-164. Throughout the Spanish regime, the royal and pontifical University of Santo Tomas remained as the highest institution of learning. (27) Run by the Dominicans, it was established as a college in 1611 by Fray Miguel de

Benavides. it initially granted degrees in theology, philosophy and humanities. (28) During the eighteenth century, the faculty of jurisprudence and canonical law was established.

In 1871, the schools of medicine and pharmacy were opened. From 1871 to 1886, the University of Santo Tomas granted the degree of Licenciado en Medicina to 62 graduates. (29) For the doctorate degree in medicine, at least an additional year of study was required at the Universidad Central de Madrid in Spain. The study of pharmacy consisted of a preparatory course with subjects in natural history and general chemistry and five years of studies in subjects such as pharmaceutical operations at the school of pharmacy. At the end of this period of the degree of Bachiller en Farmacia was granted.

The degree of licentiate in pharmacy, which was equivalent to a master's degree, was granted after two years of practice in a pharmacy, one of which could be taken simultaneously with the academic courses after the second year course of study. In 1876, the university granted the bachelor's degree in pharmacy to its first six graduates in the school of pharmacy. Among them was Leon Ma. Guerrero, who is usually referred to as the "Father of Philippine Pharmacy" because of his extensive work on the medicinal plants of the Philippines and their uses. (30) The total number of graduates in pharmacy during the Spanish period was 164. (31). ----- (27) There was a Royal University of San Felipe established in Manila by a royal decree of 1707. It remained open until 1726 when its work was taken over by the Jesuit University of San Ignacio which was closed in 1768. See *ibid.* , p. 31. (28) The following brief history of the University of Sto. Tomas is based on an



account written by Fray E. Arias, reproduced in United States Bureau of the Census, Census of the Philippine Islands, 1903, Vol.

III (Washington, D. C. : Government Printing Office, 1905), pp. 621-631; Blair and Robertson, *op. cit.* , Vol. XLV, pp. 141-169. (29) Arias, *op. cit.* , p. 631. (30) His works included Medicinal Plants of the Philippine Islands, published in 1903 and Medicinal Uses of Philippine Plants, published in 1921. See Miguel Ma. Valera, S. J. et al. , Scientists in the Philippines (Bicutan, Taguig, Rizal: National Science Development Board, 1974), pp. 95-114. (31) Milagros G. Nino, " Pharmaceutical Education in the Philippines," UNITAS, Vol. 3 (JUNE 1970), p. 73. There were no schools offering engineering at that time. The few who studied engineering had to go to Europe. There was a Nautical School created on 1 January 1820 which offered a four-year course of study (for the profession of pilot of merchant marine) that included subjects as arithmetic, algebra, geometry, trigonometry, physics, hydrography, meteorology, navigation and pilotage. (32) A School of Commercial Accounting and a School of French and English Languages were established in 1839. (33)

In 1887, the Manila School of Agriculture was created by royal decree but it was able to open only in July 1889. The School was designed to provide theoretical and practical education of skilled farmers and overseers and to promote agricultural development in the Philippines by means of observation, experiment and investigation. Agricultural stations were also established in Isabela, Ilocos, Albay, Cebu, Iloilo, Leyte and parts of Mindanao. The professors in the School were agricultural engineers. The School was

financed by the government but it appears that its direction was also left to the priests.

The certificates of completion of the course were awarded by the university of Santo Tomas or the Ateneo Municipal. It seems that the School was not successful as Filipinos did not show much inclination for industrial pursuits.

(34) In 1863, the colonial authorities issued a royal decree designed to reform the existing educational system in the country. It provided for the establishment of a system of elementary, secondary and collegiate schools, teacher-training schools, and called for government supervision of these schools.

The full implementation of this decree, however, was interrupted by the coming of the Americans in 1898. Higher education during the Spanish regime was generally viewed with suspicion and feared by the colonial authorities as encouraging conspiracy and rebellion among the native Filipinos. For this reason, only the more daring and persevering students were able to undertake advantaged studies. The attitude of the Spanish friars towards the study of the sciences and medicine was even more discouraging. As one Rector of the University of Santo Tomas in the 1960s said: " Medicine and the natural sciences are ----- (32) Blair and Robertson, *op. cit.* , Vol. XLV, pp. 241-243. (33) Census of the Philippine Islands, 1903, *op. cit.* , pp. 613-615. (34) " School of Agriculture," in Blair and Robertson, *op. cit.* , Vol. XLV, pp. 315-318. The required course of study included subjects such as mathematics, physics, chemistry, natural history, agriculture, topography, linear and topography drawing, etc. as well as practical work. materialistic and impious studies. (35) It was not surprising,

therefore, that few Filipinos ventured to study these disciplines. Those who did were poorly trained when compared with those who had gone to European universities. Science courses at the University of Santo Tomas were taught by the lecture/recitation method. Laboratory equipment was limited and only displayed for visitors to see. There was little or no training in scientific research. (36) Sir John Bowring, the British Governor of Hongkong who made an official visit to the Philippines in the 1850s wrote:

Public instruction is in an unsatisfactory state in the Philippines--the provisions are little changed from those of the monkish ages. In the University of Santo Tomas... no attention is given to the natural sciences... nor have any of the educational reforms which have penetrated most of the colleges of Europe and America found their way to the Philippines. (37) In spite of the small number of Filipino graduates from the UST in medicine and the sciences they still faced the problem of unemployment.

This was because the colonial government preferred to appoint Spanish and other European-trained professionals to ----- (35) Quoted in James A. Le Roy, *Philippine Life in Town and Country* (New York and London: G. P. Putnam's Sons, 1905) p. 206. (36) This can be seen from a description of a physics class at the University of Santo Tomas by Jose Rizal in a chapter of his second novel, *El Filibusterismo* (The Subversive) written in Europe in 1891. At the start of the American regime, a German physician of Manila submitted a report to the authorities on the conditions at UST's medical college.

The report mentions, among others, its lack of library facilities, the use of outdated textbooks (some published in 1845), that no female cadaver had ever been dissected and the anatomy course was a "farce", that most

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graduates " never had attended even one case of confinement or seen a case of laparotomy" and that bacteriology had been introduced only since the American occupation and " was still taught without microscopes! " See Le Roy, *op. cit.* , pp. 205-206. (37) Sir John Bowring, *A Visit to the Philippine Islands* (London: Smith & Elder Co. 1858), p. 194. See also Robert MacMicking, *Recollections of Manila and the Philippines during 1848, 1849, and 1850*, ed. and annotated by Morton J. Netzorg (Manila: Filipiniana Book Guild, 1967, reprint of 1851 book published in London by Richard Bentley), pp. 31-32. available positions in the archipelago. (38) Many of these graduates later joined the revolutionary movement against Spain. With the opening of the Suez Canal in 1869 and the consequent ease in travel and communications that it brought about, the liberal ideas and scientific knowledge of the West also reached the Philippines. The prosperity that resulted from increased commerce between the Philippines and the rest of the world enabled Filipino students to go to Europe for professional advanced studies. These included Jose Rizal who was able to pursue studies in Medicine and specialize in ophthalmology in Spain and Germany; Graciano Apacible who studied medicine in Madrid; Antonio Luna who obtained his Ph. D. in pharmacy in Madrid and later worked with renowned scientists in Ghent and Paris; (39) Jose Alejandrino who took up engineering in Belgium, and others.

It was this group of students which set up the Propaganda Movement in Europe that eventually led to the Philippine revolution against Spain. The religious orders provided most of the teaching force and institutions of learning in the colony. This was similar to the situation that had earlier

prevailed in Europe (where they had come from) during the medieval ages. Inevitably, members of the religious orders also took the lead in technological innovation and scientific research.

This involvement invariably arose from their need to provide for basic necessities as they went around the archipelago to perform their missionary work of propagating the Catholic faith and to finance the colleges, hospitals and orphanages that they had established. The Spaniards introduced the technology of town planning and building with stones, brick and tiles. In many places, the religious (such as Bishop Salazar in Manila) personally led in ----- (38) Alzona, *op. cit.* , pp. 43-144, cited a memorial sent to the Madrid exposition in 1887 by officials of the University of Santo Tomas criticizing this government policy and urging its change " in order to prevent political disturbances which might be caused by the large number of dissatisfied professional men who could not find work. " See also Census of the Philippine Islands 1903, *op. cit.* , pp. 632-633. Apolinario Mabini wrote: " All the departments and provincial governments were staffed with peninsular Spaniards personnel unfamiliar with the country and relieved every time there was a cabinet change (in Madrid).

Very few Filipinos secured employment as army officers, as officials in the civil administration, or as judges and prosecuting attorneys.. ," See his *The Philippine Revolution* translated into English by Leon Ma. Guerrero (Manila: Department of Education. National Historical Commission, 1969), p. 27. (39) Vivencio R. Jose, *The Rise and Fall of Antonio Luna*. Special Issue of *Philippine Social Sciences and Humanities Review*. Vol. XXXVI, Nos. 1-4 (March-December 1971), pp. 43-48. these undertakings. 40) Because of the lack of

skilled Filipinos in these occupations, the Spaniards had to import Chinese master builders, artisans and masons. The native Filipinos were drafted, through the institution of compulsory labor services, to work on these projects. In this manner, the construction of the walls of Manila, its churches, convents, hospitals, schools and public buildings were completed by the seventeenth century. (41) Towards the end of the sixteenth century, the religious orders had established several charity hospitals in the archipelago and in fact provided the bulk of this public service.

These hospitals became the setting for rudimentary scientific work during the Spanish regime long before the establishment of the University of Santo Tomas (UST) college of medicine. Research in these institutions were confined to pharmacy and medicine and concentrated on the problems of infectious diseases, their causes and possible remedies. (42) Several Spanish missionaries observed, catalogued and wrote about Philippine plants, particularly those with medicinal properties. The most notable of these was Father Fernando de Sta.

Maria's *Manual de Medicinas Caseras* published in 1763 which was so in demand that it had undergone several editions by 1885. (43) By the second half of the nineteenth century, studies of infectious diseases such as smallpox, (44) cholera, bubonic ----- (40) de la Costa, op. cit. , pp. 28, 31-33. (41) For a description of Manila during this period, see Giovanni Francesco Gemelli Careri, *A Voyage to the Philippines* (originally published in London, 1744-46; reprinted in Manila: Filipiniana Book Guild, 1963), Chap. . (42) Euologio B. Rodriguez, " Brief observations on Science in the Philippines in the Pre-American Era," National Research Council of the Philippines Islands <https://assignbuster.com/history-of-science-and-technology-in-the-phillippines/>

(NRCF), Annual Report, 1934-35, bulletin No. 43 (Manila: February 1935), pp. 84-128; J. P. Bantug, " The Beginnings of Medicine in the Philippines," NRCF, op. cit. , Bulletin No. 4, pp. 227-246; Vicente Ferriols, " Early History of Veterinary Science in the Philippine Islands," NRCF, ibid. , pp. 334-337; M. V. del Rosario, " Chemistry in the Pre-American Regime," NRCF, op. cit. bulletin No. 5, pp. 359-362. (43) Eduardo Quisumbing, " Development of Science in the Philippines," Journal of East Asiatic Studies, Vol. VI, No. 2 (April 1957), p. 132. (44) As early as 1803, an edict was passed to control smallpox by introducing vaccination. In 1806, a Board of Vaccination was set up to take charge of the propagation and preservation of the virus against smallpox. See Hilario Lara, " Development of Hygiene and Preventive Medicine (PublicHealth) in the Philippines," NRCF, op. cit. , Bulletin No. 4, pp. 265-266. plague, dysentery, leprosy and malaria were intensified with the participation of graduates of medicine and pharmacy from UST. (45) At this time, native Filipinos began to participate in scientific research. In 1887, the Laboratorio Municipal de Ciudad de Manila was created by decree. Its main functions were to conduct biochemical analyses for public health and to undertake specimen examinations for clinical and medico-legal cases. It had a publication called Cronica de Ciencias Medicas de Filipinas showing scientific studies being done during that time. 46) There was very little development in Philippine agriculture and industry during the first two centuries of Spanish rule. This was largely due to the dependence of the Spanish colonizers on the profits from the Galleon or Manila-Acapulco trade, which lasted from 1565 to 1813. It was actually based on the trade with China which antedated Spanish rule. (47) The galleons brought to Latin America Chinese goods --

silk and other cloths, porcelain and the like -- and brought back to ManilaMexicansilver.

When the Spanish and Portuguese thrones were united from 1581 to 1640, goods brought to Manila by ships from Japan and Portuguese ships from Siam, India, Malacca, Borneo and Cambodia were also carried by the galleons to Mexico. (48) During the this time, Manila prospered as the entrepot of the Orient. The Filipinos hardly benefited from the Galleon trade. Direct participation in the trade was limited to Spanish inhabitants of Manila who were given shares of lading space in the galleons.

Many of them simply speculated on these trading rights and lived off on their profits. It was the Chinese who profited most from the trade. They acted as the trade's packers, middlemen, retailers and also provided services and other skills ----- (45) Specimens were usually submitted to pharmacists for examination. Thus drugstores, notably the Botica Boie and Botica de Santa Cruz in Manila, served as research laboratories as well as manufacturers of drugs and household remedies.

See Patrocinio Valenzuela, " Pharmaceutical Research in the Philippines," in NRCP, op. cit. , Bulletin No. 5, pp. 404-406. (46) Anacleto del Rosario, one of the first graduates of pharmacy at UST, was appointed as the first director of the Laboratorio. He pioneered in bacteriological research, particularly in the search for causes of cholera, tuberculosis and leprosy and investigated the origin of beriberi which was one of the leading causes of death during that time. See Varela, et al. , op. cit. , pp. 173-189. 47) Fedor Jagor, Travels in the Philippines (Reprint of 1875 English ed. , (Manila: Filipiniana Book Guild, 1965), chap. 2; William, Lytle Schurz, The Manila Galleon (New York: E. P. <https://assignbuster.com/history-of-science-and-technology-in-the-phillippines/>



Dutton, 1959); Cushner, Spain in the Philippines, chap. 6. (48) Morga, op. cit. , pp. 287; 304-309. which the Spanish community in Intramuros needed. (49) Spanish preoccupation with the Manila Galleon eventually led to the neglect of agriculture and mining and the decline of native handicrafts and industries in the Philippines.

The deleterious effects of the trade on the archipelago's domestic economy had been pointed out by some Spanish officials as early as 1592. (50) But this seems to have been largely ignored by colonial policy-makers. Only the local shipbuilding industry continued to prosper because of necessity -- to build the galleons and other ships required for internal commerce and the defense of the archipelago. This had become quite well developed according to a French visitor in the nineteenth century. He observed:

In many provinces shipbuilding is entirely in the hands of the natives. The excellence of their work is proof that they are perfectly capable of undertaking the study of abstruse sciences and that mathematical equations are by no means beyond their comprehension.... (51) Agricultural development was left to the resident Chinese and the Spanish friars. The latter saw in the cultivation of their large estates around Manila a steady source of financial support for their churches, colleges, hospitals and orphanages in Intramuros.

The friar estates profited from the expanding domestic food market as a result of the population growth of Manila and its suburbs. (52) But the friars' contribution in the development of existing agricultural technology was more of quantitative than qualitative in nature. (53) The profitability of their estates was largely derived from the intensive exploitation of native  
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technology and their free compulsory personal services. ----- (49) Ibid. , pp. 314-316; de la Costa, op. cit. , pp. 39-41. (50) de la Costa, op. cit. , pp. 9-40; Morga, op. cit. , p. 310. (51) Jean Baptiste Mallat de Bassilan, *Les Philippines* (Paris: Arthus Bertrand, 1846), in de la Costa, op. cit. , pp. 154-155. McMicking, op. cit. , pp. 264-266, has similar positive observations on shipbuilding during that time. (52) See Nicholas P. Cushner, *The Landed Estates in the Colonial Philippines* (Monograph Series No. 20; New Haven Conn: Yale University Southeast Asia Studies, 1976). (53) Paul P. de la Gironiere, *Twenty Years in the Philippine Islands* (New York: Harper & Bros. Publishers, 1854), pp. 306-307, has sketches showing the simple agricultural tools and implements still used during the mid-nineteenth century. Successive shipwrecks of and piratical attacks on the galleons to Mexico led to declining profits from the trade and triggered an economic depression in Manila during the latter part of the seventeenth century. (54) This situation was aggravated by increasing restrictions on the goods carried by the Manila Galleon as a consequence of opposition coming from Andalusian merchants and mercantilists in Spain.

At the beginning of the eighteenth century, the Bourbon dynasty ascended to the Spanish throne and brought with it political and economic ideas of the French Enlightenment. This paved the way for more government attention to the economic development of the Philippines. Enterprising Spaniards began to exploit the mineral wealth of the islands, develop its agriculture, and establish industries. These efforts were further encouraged by the need to promote economic recovery after the British Occupation of Manila in 1762-1764. (55)

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Research in agriculture and industry was encouraged by the founding of the Real Sociedad Economica de los Amigos del Pais de Filipinas (Royal Economic Society of Friends of the Philippines) by Gobernador Jose Basco y Vargas under authority of a royal decree of 1780. Composed of private individuals and government officials, the Society functioned somewhat like the European learned societies during the eighteenth and nineteenth centuries and a modern National Research Council, (56) It undertook the promotion of the cultivation of indigo, cotton, cinnamon, and pepper and the development of the silk industry.

During the nineteenth century, it was endowed with funds which it used to provide prizes for successful experiments and inventions for the improvement of agriculture and industry: to finance the publication of scientific and technical literature, trips of scientists from Spain to the Philippines, professorships; and to ----- (54) de la Costa, op. cit. , pp. 106-107. (55) For accounts of those attempts to promote mining and industrial development, see *ibid.* , pp. 107-114; Cushner, *Spain in the Philippines*, pp. 186-194. 56) The Society's early organization included sections of natural history, agriculture, and rural economy, factories and manufactures, industries and popular education. See Benito Legarda, Jr. , " Foreign Trade, Economic Change and Entrepreneurship in the Nineteenth Century Philippines" (Ph. D. dissertation submitted to the Department of Economics, Harvard University, Cambridge, Mass. , 1955), pp. 117-119, 321-326; Patrocinio Valenzuela, " A Historical Review of Movements to Establish a Research Council of the Philippines, in *NRCP*, op. cit. , Bulletin No. , pp. 77-79; Blair and Robertson, op. cit, Vol. LII, pp. 289-324; Cushner, *Spain in the*

Philippines, pp. 194-195. provide scholarships to Filipinos. (57) In 1789, Manila was opened to Asian shipping. This inaugurated an era of increasing Philippine exports of rice, hemp, sugar, tobacco, indigo and others and rising imports of manufactured goods. (58) In 1814, Manila was officially opened to world trade and commerce; subsequently other Philippine ports were opened. Foreign capital was allowed to operate on an equal footing with Spanish merchants in 1829.

By this means agricultural production particularly of sugar and hemp, was accelerated and modernized. Local industries flourished in Manila and its suburbs -- weaving, embroidery, hatmaking, carriage manufacture, rope-making, cigar and cigarettes-making. (59) Much of the finished products of these industries were exported. Yet although Philippine exports kept rising during the nineteenth century, imports of manufactured goods also rose and foreign, particularly English capital dominated external trade and commerce. (60) This partly because of short-sighted Spanish colonial trade policies and the relative inexperience and lack of capital of Spanish colonial trade policies and the relative inexperience and lack of capital of Spanish and Filipino merchants. The prosperity arising from expanded world trade and commerce in the nineteenth century led to Manila's rapid development as a cosmopolitan center. Modern amenities -- a waterworks system, steam tramways, electric lights, newspapers, a banking system -- were introduced into the city by the latter half of the nineteenth century. (61) Undoubtedly, commercial needs led to the Spanish governments establishment of a Nautical School, vocational schools and a School of Agriculture during the nineteenth century. Various offices and commissions were also created by

the Spanish \_\_\_\_\_ (57) Blair and Robertson, op. cit. , Vol. LI, pp. 38-39. (58) de la Costa, op. cit. , pp. 138-142; Cushner, Spain in the Philippines, pp. 195-197. (59) de la Costa, op. cit. , pp. 143-160; Cushner, Spain in the Philippines, op. cit. , pp. 197-209; McMicking, op. cit. , chaps.

XXVI-XXVII; Bowring, op. cit. chap. I. (60) Carlos Recur, Filipinas; Estudios Administrativos y Comerciales (Madrid: Imprenta de Ramon Moreno y Ricardo Rojas, 1879), pp. 93-122. Recur observed (p. 110) that from the commercial point of view, the Philippines was an Anglo-Chinese colony flying the Spanish flag ("... bajo el punto de vista comercial Filipinas es una colonia anglo-china con bandera epola... "). (61) John Foreman, The Philippine Islands (London: Sampson Low, Marston, Searle and Rivington, Ltd. , 1890), chap. ; McMicking, op. cit. , chap. XXV. government by the Spanish government to undertake studies and regulations of mines, research on Philippine flora, agronomic research and teaching, geological research and chemical analysis of mineral waters throughout the country. (62) However, little is known about the accomplishments of these scientific bodies. Meteorological studies were promoted by Jesuits who founded the Manila Observatory in 1865. The Observatory collected and made available typhoon and climatological observations.

These observations grew in number and importance so that by 1879, it became possible for Fr. Federico Faura to issue the first public typhoon warning. The service was so highly appreciated by the business and scientific communities that in April 1884, a royal decree made the Observatory an official institution run by the Jesuits, and also established a network of meteorological stations under it. (63) In 1901, the Observatory was made a

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central station of the Philippine Weather Bureau which was set up by the American colonial authorities.

It remained under the Jesuit scientists and provided not only meteorological but also seismological and astronomical studies. The benefits of economic development during the nineteenth century were unevenly distributed in the archipelago. While Manila prospered and rapidly modernized, much of the countryside remained underdeveloped and poor. The expansion of agricultural production for export exacerbated existing socio-economic inequality, that had been cumulative consequence of the introduction of land as private property at the beginning of Spanish rule.

There was increasing concentration of wealth among the large landowners -- the Spaniards, especially the religious orders, the Spanish and Chinese mestizos, the native Principalia -- and poverty and landlessness among the masses. This inequality, coupled with abuses and injustices committed by the Spanish friars and officials gave rise to Philippine nationalism and eventually the Revolution of 1896. ----- 62) There were the Inspeccion General de Minas created by Royal Decree in 1837; Commission de Flora de Filipinas, 1876; Comision Agronomica de Filipinas, 1881; Comision Especial de Estudios Geologicos y Geograficos de Filipinas, 1885; and Comision de Estudios de las Aguas Minero Medicinales, 1884. See Leoncio Lopez Rizal, " Scientific and Technical Organizations in the Philippine Islands," in NRCP. op. cit. , Bulletin No. 3, pp. 155-159. (63) The meteorological studies done at the Observatory, notably by Jose Algue Sanllei, became world renowned.

Some were subjects of discussion at International Meteorological Congresses and were published in the Journal of the Royal Meteorological Society in London. See John N. Schumacher, "One Hundred Years of Jesuit Scientists: The Manila Observatory 1865-1965," *Philippine Studies*, Vol. 13 (1965), pp. 258-286; Valera, *op. cit.*, pp. 1-22. At the end of the Spanish regime, the Philippines had evolved into a primary agricultural exporting economy. Progress in agriculture had been made possible by some government support for research and education in this field.

But it was largely the entry of foreign capital and technology which brought about the modernization of some sectors, notably sugar and hemp production. The lack of interest in and support for research and development of native industries like weaving, for example, eventually led to their failure to survive the competition with foreign imports. Because of necessity and the social prestige attached to university education, medicine and pharmacy remained the most developed science-based professions during the Spanish regime. Science and Technology During the First Republic

There was very little development in science and technology during the short-lived Philippine Republic (1898-1900). The government took steps to establish a secular educational system by a decree of 19 October 1898, it created the Universidad Literaria de Filipinas as a secular, state-supported institution of higher learning. It offered courses in law, medicine, surgery, pharmacy and notary public. During its short life, the University was able to hold graduation exercises in Tarlac on 29 September 1899 when degrees in medicine and law were awarded. (64) Developments in Science and Technology

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During the American Regime Science and technology in the Philippines advanced rapidly during the American regime. This was made possible by the simultaneous government encouragement and support for an extensive public education system; the granting of scholarships for higher education in science and engineering; the organization of science research agencies and establishment of science-based public services. The Americans introduced a system of secularized public school education as soon as civil government was set up in the islands.

On 21 January 1901, the Philippine Commission, which acted as the executive and legislative body for the Philippines until 1907, promulgated Act No. 74 creating a Department of Public Instruction in the Philippines. It provided for the establishment of schools that would give free primary education, with English as the medium of instruction. This was followed by the setting up of a Philippine Normal School to train Filipino teachers. Secondary schools were opened after a further enactment of the Philippine in ----- (64) Most of its faculty and students had actually come from the University of Santo Tomas.

See Alzona, *op. cit.* , pp. 177-180; Teodoro A. Agoncillo, *Malolos; The Crisis of the Republic* (Quezon City: University of the Philippines Press, 1960), pp. 250-251. Commission in 1902. The Philippine Medical School was established in 1905 and was followed by other professional and technical schools. These were later absorbed into the University of the Philippines. The colonial authorities initially adopted a coordinated policy for the promotion of higher education in the sciences and government research institutions and agencies performing technical functions.

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The University of the Philippines was created on 18 June 1908 by Act of the Philippine Legislature. Among the first colleges to be opened were the College of Agriculture in Los Banos, Laguna in 1909, the Colleges of Liberal Arts, Engineering and Veterinary Medicine in 1910 and the College of Law in 1911. By 1911, the University had an enrollment of 1, 400 students, (65) Four Years later, its enrollment had almost doubled (to 2, 398) and the University included two new units, a School of Pharmacy and a Graduate School of Tropical Medicine and Public Health. 66) In 1916, the School of Forestry and Conservatory of Music were established; and in 1918, the College of Education was opened. Except in the College of Medicine, where there were already a number of Filipino physicians who were qualified to become its faculty members when it was opened in 1907, most of the early instructors and professor in the sciences and engineering at the University of the Philippines were Americans and other foreigners. Qualified Filipinos were sent abroad for advanced training and by this means foreign faculty were gradually replaced by Filipinos. For example, in 1920, Filipino Ph.

D. graduates of U. S. universities took over the Department of Agriculture Chemistry in the College of Agriculture. By December 1926, the university's enrollment in all colleges had reached 6, 464 and out of a total teaching staff of 463, only 44 were Americans and other foreigners. (67) -----

(65) Distributed among its various colleges and follows: College of Liberal Arts -- 215, College of Medicine and Surgery - 56, College of Agriculture -- 186, College of Veterinary Science -- 14, College of Engineering -- 11, College of Law -- 154 and School of Fine Arts -- 801.

See Census Office of the Philippine Islands, Census of the Philippine Islands, 1918) Vol. IV, Part II: Schools Universities, Commerce and Transportation, Banks and Insurance (Manila: Bureau of Printing, 1921), p. 602. (66) See *ibid*, p. 608. (67) Findings of the Monroe Survey of Education in the Philippines cited in W. Cameron Forbes, *The Philippine Islands Vol. I* (Boston and New York: Houghton Mifflin Co. , 1929) p. 477. Before 1910, the American colonial government encouraged young men and women to get higher professional education as much as possible in American colleges.

In 1903, the Philippine commission passed an Act to finance the sending of 135 boys and girls of high school age to the United States to be educated as teachers, engineers, physicians and lawyers. (68) One third of these were chosen by the governor-general on a nation-wide basis and the rest by the provincial authorities. In exchange for this privilege, the *pensionados*, as they came to be called, were to serve in the public service for five years after their return from their studies. Between 1903 and 1912, 209 men and women were educated under this program in American schools. (69) After the establishment of the University of the Philippines, scholarships for advanced studies of a scientific or technical nature in American Universities were given only in preparation for assignment to jobs in the public service. The Philippine Commission introduced science subjects and industrial and vocational education into the Philippine school system but they found that industrial and vocation courses were very unpopular with the Filipinos. When the Manila Trade School was opened in 1901, the school authorities found it difficult to get students to enroll in these courses.

Because of their almost 400 years of colonial experience under the Spaniards, middle class Filipinos had developed a general disdain for manual work and a preference for the prestigious professions of the time, namely, the priesthood, law and medicine. Education in these professions came to be regarded as the means of making the best of the limited opportunities in the Spanish colonial bureaucracy and thus of rising from one's social class. Hence, even at the newly-opened University of the Philippines, it was difficult to get students to ----- The University began in 1911 with a faculty of only 36 scholars with the rank of assistant professor or higher, of which only five (14 per cent) were Filipinos, mostly from the College of Medicine. The remaining members of the faculty were Americans or in one or two cases other foreign professionals. In 1925, of 150 faculty members with the rank of assistant professor or higher, 117 (78 per cent) were Filipinos and 33 (22 per cent) were American or other foreign scholars. See Harry L. Case and Robert A.

Bunel, *The University of the Philippines; External Assistance and Development* (East Lansing, Michigan: Institute for International Studies in Education, Michigan State University, 1970), p. 10, Table 1. (68) Forbes, *op. cit.*, p. 457 (69) Charles Burke Elliott, *The Philippines to the End of the Commission Government: A Study in Tropical Democracy* (New York: Greenwood Press Publishers, 1968), p. 242. The author served as Secretary of Commerce and Police in the Philippines Commission from 1910-1912. o enroll in courses whic