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Rosa Navarro-Haydon: Struggling for Locally Relevant Science Education in Puerto Rico. 1926-1966

Rosa Navarro-Haydon: Esfuerzos por una educación científica localmente relevante en Puerto Rico. 1926-1966

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ABSTRACT:

Rosa Navarro-Haydon played a fundamental role during a critical turning point in the history of science education in Puerto Rico. This eminent scholar developed and implemented elementary-level science curricula for public schools, wrote and published science booklets, articles and textbooks and trained thousands of science teachers. Rosa Navarro-Haydon was one of the first scholars to engage in science communication activities in Puerto Rico, such as writing science magazine articles for the general public. Unfortunately, education and scientific communities are unaware of the countless professional contributions made by Rosa Navarro-Haydon and her life as a science educator pioneer in Puerto Rico.

KEYWORDS: Science Education, History of Education, Science Textbooks, Science Communication, Science Museums.

RESUMEN:

Rosa Navarro-Haydon participó de manera fundamental en un momento crítico de la historia de la educación científica en Puerto Rico. Esta investigadora y educadora desarrolló e implementó el currículo científico de las escuelas públicas primarias, escribió folletos, artículos académicos y libros de texto. Además, fue responsable de preparar profesionalmente a miles de docentes de ciencias. Rosa Navarro-Haydon fue una pionera de la diseminación científica y escribía artículos en revistas dirigidas al público en general. Lamentablemente, las comunidades científicas y educativas desconocen las grandes contribuciones profesionales de Rosa Navarro-Haydon, su vida y obra como una de las primeras educadoras científicas en Puerto Rico y el contexto histórico en el cual sucedieron.

PALABRAS CLAVE: Educación científica, Historia de la educación científica, Libros de texto de ciencia, Comunicación científica, Museos de ciencia.

INTRODUCTION

Rosa Navarro-Haydon was born on February 9, 1905, in Redlands, California. Her parents, Saturnino Navarro and Genoveva Carrión were Mexican nationals who initially moved to El Paso, Texas where she completed her elementary school at the *Bailey School* and, subsequently, to northwestern Puerto Rico where she completed her high school degree at *Aguadilla High School* around 1920. Her academic credentials included a Bachelor's Degree in Education from the University of Puerto Rico Río Piedras (1926), a Master's Degree in Science Education with an emphasis in Educational Administration from Columbia University, New York (1930), and a second Master's Degree in Business Education in 1935 (University of Puerto Rico, 2016). Navarro-Haydon (Figure 1) developed and implemented elementary-level science curricula for public schools, published science booklets, scholarly journal articles and textbooks and trained hundreds of pre-service and in-service science teachers. She also served as Director of the first Museum of Biological Sciences in Puerto Rico and engaged in science communication activities on the Island as a writer for local magazines.



FIGURE 1
Professor Rosa Navarro-Haydon
Source: University of Puerto Rico (2016).

This article provides an overview of the life and work of Rosa Navarro-Haydon, a pioneer in science education in Puerto Rico and frames her contributions within the historical context of the first half of the 20th century, where social and psychological barriers for women scientists were prevalent (White, 1970). Like many female scientists from the early 20th century, Navarro-Haydon's story remained obscure for years (Rossiter, 1974) to later regain interest and prompt further research among historians of science education.

Navarro-Haydon's significant and much-needed contributions occurred within the context of a pivotal moment in the history of education in Puerto Rico. After the Spanish-American War of 1898, The United States gained control of Cuba, the Philippines, Puerto Rico, and Guam.

The educational systems in these countries were based on the Spanish model which was very different from that of the United States. As a result, both students and teachers experienced an abrupt transformation that can be explored from a theoretical framework of contextual and multicultural education. As the following literature review demonstrates, textbooks and curricula transplanted from the United States to Puerto Rico did not provide a familiar contextual and multicultural framework that local students could assimilate.

Teaching in context occurs when present real situations that encompass aspects like the physical setting, the purpose of the lesson, the participants, and the social norms (Ares, 2011; Fensham, 2009). Johnson (2002) argued that teaching in context promotes learning because students see meaning in the academic material, connect new information with prior knowledge and their own experience, and make transitions between the unknown and the familiar. Since learning is continuously shaped by sociocultural contexts (Alexander & Murphy, 1999; Falk & Storksdieck, 2005), teachers and students bring contextual factors to education as a set of prior experiences, beliefs and values about instruction, demographic factors, as well as accumulated knowledge about the curriculum (Meyer & Crawford, 2011).

The effects of contextualized and decontextualized curricula have been thoroughly documented in the educational literature. A classic example of the challenges of a decontextualized curriculum was

provided by Erickson & Mohatt (1982) and classroom discourses in an American curriculum with Native-American students. On the other hand, Tharp (1982), provided a classic example of how a carefully contextualized curriculum can be successful when he reported the results of an elementary reading curriculum, the Kamehameha Early Education Program, which was carefully designed to consider distinct cultural characteristics pertaining to students of Polynesian and Hawaiian ancestry. González et al. (2014) described a more recent example of the success of contextualized school materials and the positive effects of introducing *Ciencia Boricua* to students (González, Colón, & Feliú, 2011) to the curriculum, which consisted of 62 essays by local scientists about local science. The language used in these essays was highly accessible, and often referred to common experiences and popular stories that are part of the Puerto Rican idiosyncrasy.

An idea related to contextualization is that of multicultural education, a field of study and an emerging discipline whose major aim is to create equal educational opportunities for students from diverse racial, ethnic, social-class and cultural groups (Banks & McGee, 2004; Gay, 2018; Nieto & Bode, 2018). Grant & Chapman (2003) argued that multicultural education operated as a philosophy, by building the ideals of freedom, justice, equality, equity, and human dignity, and as an educational process by providing knowledge about the history, culture, and contributions of diverse groups of society.

From a historical perspective, issues related to contextual and multicultural education, and other socioculturally transformative research methods that intersect history, curriculum, systemic initiatives, epistemology, culture, teaching and language, emerged from the 1950s and 1960s civil rights movements of various historically oppressed groups (Banks, 1993). In comparison, much of the professional work of Prof. Navarro Haydon predates the scholarly and theoretical formalization of contextual and multicultural education of the 1970s, mostly due to the unique political and cultural situation of Puerto Rico.

PUERTO RICO: EDUCATION IN TRANSITION 1814-1930.

During the earlier part of the 19th century, secondary education in Puerto Rico was practically nonexistent. Catholic priests in San Juan taught general courses in Latin grammar, the trivium and quadrivium. Although those courses were primarily intended for future priests, interested students without religious inclinations also had access to these courses (López, 1991).

During the course of that century, modest efforts, led by social and religious organizations attempted to promote education on the Island. In 1814, the Economic Society of the Country's Friends (ESCF), a non-profit organization, started teaching mathematics and drawing to a very limited number of students. In 1823, the Catholic Church opened the Conciliar Seminary to candidates for priesthood and laymen, where courses in Latin, theology, philosophy, and morality were offered. From 1832 to 1841, Dr. Rufo Manuel Fernández, a priest from Galicia, Spain, began to teach science classes in Puerto Rico together with ESCF (Alonso, 1849; López, 1991). From 1843 to 1858, courses taught by ESCF became integrated with Conciliar Seminary courses, creating a curricular sequence equivalent to that of Spain's secondary schools. Before the 1880s, upper class families sent their children to Cuba, Spain and France to attend boarding schools where they completed their secondary education.

In 1882, the Spanish government opened the Province Institute for Secondary Education (PISE), the only educational institution, at the time, that was authorized to offer secondary (high school) degrees. Various private secondary institutions then emerged in the larger cities of Ponce, Mayaguez, Caguas, Humacao, Guayama, and Arecibo. However, these institutions had to be associated with PISE for their students to graduate. Given the lack of qualified local teachers, most of the faculty came from Spain.

Despite efforts from the Spanish government to promote literacy in Puerto Rico, after the United States took possession of the Island, there were only 529 primary schools and a population of 940,000. The literacy rate was reported at approximately 20%. The transformation of Puerto Ricans from Spanish

to Americans through public education began almost immediately (Negrón de Montilla, 1990). Local Education Commissioners (LEC) were assigned to develop public instruction. Although the scope and quality of the Puerto Rican educational system significantly improved during the 1900-1930s. Two controversial goals included Americanizing the population and teaching of English (Osuna, 1949). Foremost LECs and their contribution to these objectives included:

General John Eaton (1899). Examined school laws, texts, and methods of instruction established by the Spanish government, replacing them with a School Code. This document was met with criticism from a variety of organizations, particular local teachers trained in Spain and France. Critics argued that the School Code, was a carbon copy of the Massachusetts Code, not adapted to local conditions and not applicable to the Puerto Rican context.

Martin Grove Brumbaugh (1900) After the approval of the Foraker Act, formalized the LEC position, describing its roles and responsibilities (Raffucci, 1981). Prepared a new School Act, known as the Act for the Establishment of a Public School System in Puerto Rico. Brumbaugh focused developing elementary schools, obtaining funds for students to continue their secondary education in the United States, establishing libraries and construction of school buildings. He hired teachers from the United States to teach primary school, institutionalized teaching of English, implemented strategies to create American patriotism among Puerto Rican students and helped create the Insular Normal School, which would later become the University of Puerto Rico (Negrón de Montilla, 1990).

Samuel McCune Lindsay (1901-1904) Closely followed his predecessor's policies for Americanization and the teaching of English as a school subject. To promote this, Lindsay emphasized the use of textbooks imported from the United States (Puerto Rico Department of Public Instruction, 1903), coordinated a novel scholarship program in which Puerto Rican teachers received scholarships to attend summer classes at Cornell and Harvard universities, and transformed the Normal School into the University of Puerto Rico.

Roland F. Falkner (1904) Put a Linguistic Policy from 1905-1916 which eliminated teaching English and replacing it with teaching most school subjects entirely in English. The policy faced strong resistance from a sector of the Puerto Rican society who argued that it was impossible to learn if the language of instruction was not understood:

English began to be taught in first grade following the 1905 plan by Commissioner Falkner, violating...the most elementary principles of pedagogy. School work was hard, unpleasant and boring for children whose only means of expression was in Spanish at school and home, and for the teacher, whose English proficiency was too limited for effective teaching (Muñiz, 1950, p. 11).

Edwin G. Dexter (1907) Required all teachers to pass an English proficiency exam as a hiring requirement and junior and high school graduation tests to be taken in English. Introduced voluntary military education in public schools.

Paul G. Miller (1915) Modified Falkner's Linguistic Policy, authorizing teachers to teach mathematics in Spanish from grades 1-4. However, this was not what most Puerto Rican wanted – that all classes be taught in Spanish and English as a Second Language. After the United States entered World War I, patriotism was fostered among local students. Yet, confrontations and pushback were frequent among high school, university students and other organizations that supported independence from the US.

Juan B. Huyke, (1921) First LEC born in Puerto Rico. Despite his local origin, he prioritized not making any changes to the school system to better serve Puerto Rican students. Huyke was an *asimilista* [assimilationist], a person who advocated that English should be the language of instruction on the Island, to assimilate to the colonist culture. His educational policies regarding the use of English in schools, English proficiency among teachers, use of textbooks imported from the United States, was not much different from that of previous Education Commissioners and satirized in literature from that historical period (Díaz, 1948).

High school physics curricula during the mid-1920s are a perfect example of Huyke's policy of using imported educational resources (Barnard, 1959; Court, 1972; King, 1959). The preface for the Course of Study for Physics and Chemistry (Puerto Rico Department of Public Instruction, 1925), states that the courses were outlined by the College Entrance Examination Board of New York. The textbook selected for the physics course was Practical Physics, by Millikan & Gale. Paradoxically, a list of experiments was included (eleven on mechanics, eight on heat, eleven on magnetism and electricity, four on sound, and seven on light) and students were required to use a laboratory notebook for data collection and analysis, even though most secondary schools at the time did not possess the materials, equipment or lab facilities to perform even the simplest experiments.

Jose Padín (1935). He was one of the students who participated in the study-abroad government scholarship program under Brumbaugh. His administration focused on the linguistic problem in schools, and proposed that both the Puerto Rican and the American culture could co-exist (López, 1991).

Rosa Navarro-Haydon: Early Contributions to Science Education

In 1925, the Board of Trustees of the University of Puerto Rico commissioned the International Institute of Teachers College at Columbia University to design, implement and report on a comprehensive study about the K-12 and college public educational system in Puerto Rico that described and analyzed the existing condition of the local educational system, build up rapidly over 25 years, and provided constructive suggestions for further improvement.

The study, published the next year (International Institute of Teachers College, 1926), had the objective of shedding light about the quality of teaching, the content of the program of study, the effectiveness of teacher and school supervision, and the complex problems related to the linguistic policy of the Puerto Rico Department of Public Instruction (Negrón de Montilla, 1990). One of the main findings of the Columbia Study was that the first six grades of schooling should focus on subjects other than English, and that English should not be the language of instruction until the seventh grade.

After careful analysis of the school system, Padín concurred with many of the findings in the 1926 Columbia Study and concluded that students learned Spanish and English poorly, which negatively affected how they learned other school subjects. Padín made drastic changes to the educational policy, authorizing all subjects to be taught in Spanish from grades 1-8 with English taught as a second language (Padín, 1935).

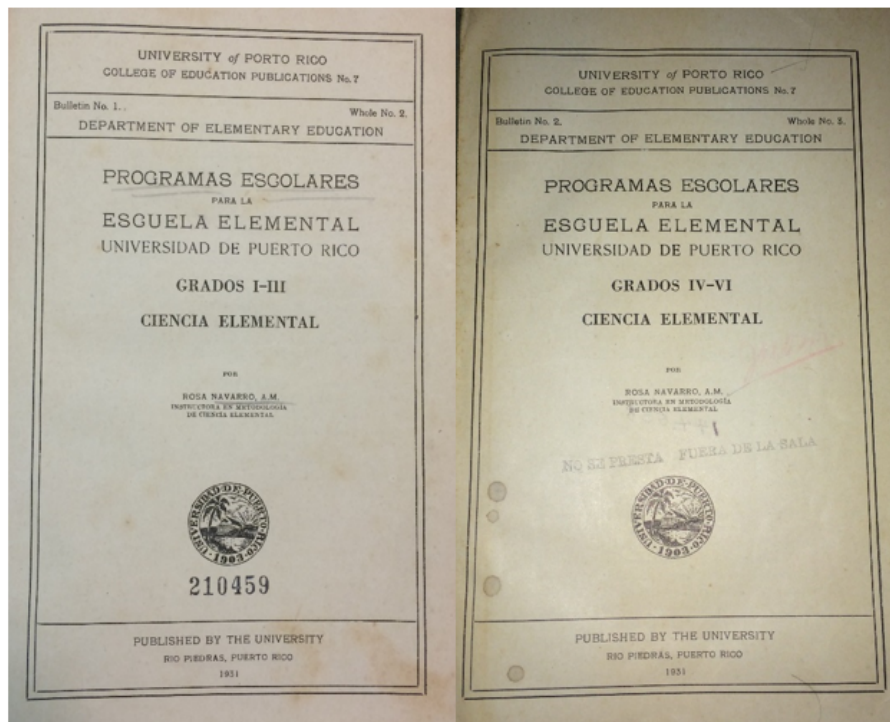


FIGURE 2
Front covers of Elementary Science Course of Study
Source: Navarro (1931a, 1931b)

After serving as Instructor of Elementary Science Education for five years, one of the most important tasks early on in Navarro-Haydon's career was to design the Puerto Rican Department of Public Instruction Elementary Science Curriculum, writing and publishing the Course of Study for 1931-1932 (Navarro, 1931a, 1931b) (Figure 2). She also published her first academic article about the importance of teaching elementary science on the Island (Navarro, 1931c) and collaborated in developing a standardized science assessment.

In 1936, Navarro-Haydon published four illustrated booklets aimed at the general public and school children, that provided useful information about the fruit trees, ornamental trees, flowers and birds of Puerto Rico (Navarro, 1936a, 1936b, 1936c, 1936d). These booklets (Figure 3) included both the common and scientific names for these trees and birds as well as illustrations of the different species and detailed physical descriptions. Simultaneously, Navarro-Haydon contributed her expertise to the *Escuela del Aire* (School of the Air) (University of Puerto Rico, 2016), which began as a pilot in February 1930 and was transmitted by the Columbia Broadcasting System, thus becoming radio's biggest single venture into education. The broadcast of the lessons provided teachers with useful tools for stimulating the minds and imagination of students. In the United States, a similar radio program included history, literature, geography, economics, science, art, civics, and music classes. Topic selection and production were carefully curated by committees of educators and professional groups (Game, 1945).



FIGURE 3
Cover page: Common Flowers of Puerto Rico
Source: Navarro (1936c).

Puerto Rico's version was called the *Puerto Rico School of the Air* which aired in September 1935 with a grant received by the Puerto Rican Department of Public Instruction from the Carnegie Corporation. In subsequent years, the initiative was funded by annual appropriations from the local government. Key leaders of the Puerto Rican School of the Air included LEC José M. Gallardo and José Leavitt, Chief of the Bureau of Adult Education and Extension Activities. Radio stations WNEL and WKAQ aired the educational programs as public service features. Programming aimed at elementary schools included disciplines such as social sciences, elementary science, English, arithmetic, folk tales, games, rhythmic, stories, music appreciation, Spanish, safety and health education and interviews with outstanding people. In addition, programs on English, Spanish, forum discussions, and music appreciation were produced for high school students. Remarkably, the *Puerto Rico School of the Air* was one of a few programs broadcast during the evening for adult and rural education (Atkinson, 1942).

In 1937, Navarro-Haydon obtained a second sabbatical to complete 18 doctoral credits at Columbia University. In addition to coursework, she was a guest speaker at their Science Education Seminar Series. The titles of her presentation included Science Education in Puerto Rico and Social Conditions in Puerto Rico. She also visited schools in the New York area to enhance her content knowledge about the latest trends and methods in science education (University of Puerto Rico, 2016).

A year later, in 1938, Navarro-Haydon obtained the rank of Assistant Professor at the Department of Pedagogy of UPRRP. An annual report of the time indicated a number of service opportunities, including (a) offering multiple professional development teacher workshops throughout the Island, including San Germán, Isabela, Juncos, Río Piedras, Arecibo, Humacao and San Juan, (b) participating in the Puerto Rico Bird and Tree Club, and (c) continuing participation in committee work for the Puerto Rico Department of Public Instruction (Elementary School Curriculum) and the UPRRP (Elementary School Teachers Curriculum). Towards the end of the 1930s she published an article on science education in Puerto Rico

published in the *Science Education Journal*, a top-tier journal to this day (Navarro, Montalvo, & Ruizanchez de Master, 1939).

NAVARRO-HAYDON AND THE MUSEUM OF BIOLOGICAL SCIENCES

Documents archived at the Charleston Museum, in South Carolina (ChM), showed that before the 1926-1927 academic year, Navarro-Haydon traveled to the mainland, where she completed a course in museum studies taught by Laura Bragg, ChM Director from 1920-1931. In a letter dated October 1927, Navarro-Haydon shared her thoughts about the course and her early efforts to develop a schoolroom museum for her biology students:

I certainly have missed the charming talks, classes, trips I had with you. You are in my mind nearly every day for I am managing my schoolroom museum according to the art principles you taught me. I do not know whether my specimens are arranged so very well, but there is a marked improvement and so I am satisfied for the time being. Of course, I have not forgotten what the aim of a museum is, so I try to fulfill it. Since I keep on collecting everything I come across, there are in my room a number of insects, starfishes, sea urchins, crustaceans, tarantulas, centipedes, millipedes, sponges, toads, lizards, fossils of snail's eggs, bivalves, snail shells, and corals. Would it be too presumptuous for me to ask you... how to preserve echinoderms and ctenophores? (Bragg, 1927, par. 1-3).

Bragg and Navarro-Haydon continued corresponding for several months. In another letter, Rosa informed Bragg about how her schoolroom museum was destroyed by a hurricane. A year later, in 1929, a letter from Bragg asked Navarro-Haydon to provide additional details about said damage (Bragg, 1927). The hurricane they referred to was the infamous Hurricane San Felipe II, a Category 5 storm that made landfall in Southeast Puerto Rico on September 1928.

The idea of a creating a biological museum remained in Navarro-Haydon's mind for many years after Hurricane San Felipe II. During the early 1940s, Navarro-Haydon continued teaching science education courses for pre-service elementary teachers. Apparently, one of the closing activities for the semester was a series of exhibits of student work. One such event was described in *La Torre*, the university newspaper (Lugo, 1943). The exhibit, which opened in May 1943, was located in the Hostos Building and visited by university leadership, faculty, students and school teachers from around the island. Student work included geological maps of Puerto Rico, a seashell collection, demonstrations of the practical uses of bamboo, an aquarium, dinosaur displays, and graphs related to various scientific phenomena.

It is likely that the university leadership saw the opportunity to establish a more permanent and useful collections of scientific exhibit and specimens. Not long after the semester ended, Dr. Carlos R. García, Interim Chair of the Department of Biological Sciences, sent a letter to Chancellor Benítez requesting the use of the classroom *Biology 21* to establish the Museum of Biological Sciences (MBS). The letter indicated that the purpose of the MBS was to enhance the instruction of general education biology courses, and provided recommendations to move classes currently scheduled in this classroom to other locations across the building (University of Puerto Rico, 2018). A few days later, Chancellor Benítez replied to Dr. García, authorizing the use of the requested classroom. The Chancellor indicated that it was his hope that the Museum would help notably to promote student interest in the biological sciences and complement academics.

In early 1944, Navarro-Haydon went on a sabbatical to visit ChM, directed at the time by Edward Milby Burton. The goal of the visit was for Navarro-Haydon to be mentored by the Charleston Museum's Curator of Vertebrate Zoology and ornithologist Edward Burnham Chamberlain, about organizing and administering a science museum. These knowledge and skills were essential information needed for Navarro-Haydon for establishing the MBS and becoming its first Director (University of Puerto Rico, 2016). Interestingly, Pedro A. Cebollero, Interim Dean of the Faculty of Education, did not want to lose Navarro-Haydon's talents if she permanently moved to the Museum's administration. In a letter to Chancellor Benítez, Prof. Cebollero argued:

In my plans for faculty organization for next year I have counted on Ms. Haydon for her classes ... Ms. Haydon informed me about certain plans related to the University museum ... Ms. Haydon is an intelligent person and a magnificent teacher. Her designation for the natural science museum would be a valuable acquisition for these services, but would deprive the faculty of a competent professional. In my judgment, it would be easier to find other personnel for the museum, than a faculty member with her abilities. (University of Puerto Rico, 2016, par. 1-2)

Navarro Haydon was very appreciative of the opportunity to participate in the ChM sabbatical. In a March 1944 letter, Navarro-Haydon expressed her thanks and interest in maintaining a collaboration:

You could have heard from me much sooner had my head been in the right place! Nevertheless, I have not forgotten you, for hardly a day goes by but that I find myself talking about you. Sometimes it's about Mr. Lunz and his crustacea or about Mr. Chamberlain and his varmints, or about Miss Simmons and her thoroughness in handling her museum school exhibits, or about Miss Panchen's exotic rings or about Miss Richardson and her shell work ... Let me know what I can do for you in Puerto Rico. It will make me very happy to be able to be of any service to any and all of you. I'll never be able to convey to you how very much I enjoyed and appreciated your kindness. (Charleston Museum, 1944, par. 1, 5)

On May 22, 1944, Dr. Carlos R. García sent a letter to Dr. Facundo Bueso, Dean of the Faculty of Natural Sciences, regarding a memorandum prepared by Prof. Navarro-Haydon and approved by him. García explained that the Department of Biological Sciences established the Museum as a small museum to serve mainly the general education class Introduction to Biological Sciences, but that it can be much more (University of Puerto Rico, 2018). García reminded Dean Bueso that Navarro-Haydon spent part of the previous semester in the United States as a Fellow of the Charleston Museum, learning about Museum Studies and acquiring the techniques needed for preparation of materials, specimens and exhibits. Consequently, he asked her a memorandum with an action plan to reorganize and expand the MBS and its services to the University and Puerto Rico in general. After revising the memorandum, García approved it and proposed a budget for storage shelving, exhibition shelving, cabinets, and salaries for the Director (Professor Navarro-Haydon), the Vice-Director (Assistant Professor Josefa Velázquez de Maceo) and an unnamed Assistant.

Dean Bueso and the upper administration responded positively to the request, proven by a letter sent by Navarro-Haydon to Chancellor Benítez on July 31, 1944, indicating the need to have access to international post mail and requesting a meeting to discuss several urgent issues related to the MBS that needed the Chancellor's input (University of Puerto Rico, 2018). A few months later, in September 1944, Chancellor Benítez sent two letters, one to Dr. Kenneth Bartlett, Federal Experimental Station, Mayaguez and another one to Mr. Luis Stefani, Vice-Chancellor of the College of Agriculture and Mechanical Arts (CAAM, currently UPR Mayaguez Campus). The letters introduced Navarro-Haydon as the Director of the MBS, explained that the Museum was recently established and that, although it was currently aimed at developing exhibits for students enrolled in introductory biology courses, future plans were to significantly expand its activities and that both Navarro-Haydon and Benítez were interested in their collaboration and advice.

By the fall of 1944, activities and science communication efforts of the MBS were in full swing. The university newspaper reported on various events and donations. In October, it was reported that the MBS was planning to offer monthly lectures by distinguished faculty to disseminate scientific information of interest to students and the public. The first conference was a lecture by Francisco Sein on the topic of Aesthetic Approaches to Biology. The article also reported that the MBS was visited by students from a private school in Cataño; that it received a donation from María Pintado de Rahn, Director of the Social Work Department at UPRRP, consisting of a collection of Caribbean mollusks, including a specimen of the species *Cassis tuberosa* and that it was exhibiting a collection of photograph by Walter Cervoni of a bifurcated tail lizard that resided in the Museum (Museo Ciencias Biológicas recibe como donación colección de moluscos, October 11, 1944). A second article that month reported that the MBS continued to develop supporting materials (preserved specimens, microscope slides and visuals) for the lectures offered in the course Introduction to Biological Science (Vivas, October 25, 1944).

In November 1944, newspaper articles reported additional activities at the MBS. One article stated that the Museum sponsored a lecture and watercolor exhibition on Birds of Puerto Rico by Frances Worth Horne, an internationally recognized botanical illustrator and naturalist who lived in Puerto Rico for 44 years. After an introduction from biology professor Ms. Ana Díaz Collazo, Ms. Horne discussed 64 species of migrating bird, 121 species of birds that reside permanently in the island and 27 native bird species. After the lecture, Navarro-Haydon highlighted the importance and uniqueness of Ms. Horne's 700+ watercolor illustrations of Puerto Rico birds and plants, and described some discussions between UPRRP and a Dr. William Jacob Robbins from the New York Botanical Gardens, to publish them to bring international attention to local fauna (Sra. F. W. Horne habló sobre "pájaros de Puerto Rico" para Museo de Biología, November 22, 1944). It is worth noting that, in 1963, Ms. Horne presented her watercolor collection as a gift to the New York Botanical Gardens, so the effort to publish them proved unsuccessful (New York Botanical Garden, 2005).

A second November article reported on Navarro-Haydon's description of recently received specimens for the MBS (Museo de Biología tiene fósiles de dos erizos era prehistórica, November 29, 1944). The first donation, from Mr. Luis A. Ferré from Ponce (and future Governor of Puerto Rico from 1969-1973) consisted of two *Clypeaster rosacea* sea urchin fossils that were found near the Ponce Cement Plant. The second donation consisted of the 6-foot skin of an *Epicrates inornatus*, a Puerto Rican boa, found in El Yunque by Miss Judith Mejías. Prof. Navarro-Haydon described the skin as magnificent, and that a scientist named Chapman Grant indicated that Puerto Rican boas were not common among scientific collections. She added that the boa was not venomous, that it only attacked as a defensive move, and that it fed on mice and other small animals.

The same article described two recently prepared exhibits at the MBS. One of them was related to systematic evolution, which included different specimens and a card with useful information. Prof. Navarro-Haydon highlighted the fish collection and clarified the differences between the natural colors and those of bottled specimens. The second exhibit was about plants, and included many classified specimens and explanatory diagrams, some of which were donated by Miss Antonia Berlinger, from the School of Medicine (Museo de Biología tiene fósiles de dos erizos era prehistórica, November 29, 1944).

Even though the MBS was established and functioning properly, correspondence between Navarro-Haydon and her colleagues at ChM suggested that she might have been overwhelmed by the responsibilities of the day-to-day operations, on top of her teaching duties. For example, in a letter from July 1944, she shared her experiences about putting the museum together:

Dear Mr. Chamberlain, do you suppose that now that I have been appointed Director of the Biology Museum, I shall have the pleasure of hearing from you? I do hope so for I really have the need ... There is a lot to do and little to direct ... Thanks to my stay at the Charleston Museum I can at least realize what my limitations are and what I must do so that something like a University Museum will come to be...(Charleston Museum, 1944, par. 1)

Navarro Haydon asked Chamberlain about a broad range of topics, such as writing specimen labels with detailed data, the need to place labels outside or inside the jar filled with preservation fluid, how to keep financial books, observations recorded from educational activities including exhibits, lectures, films, field trips and newspaper articles, finding reliable museum furniture and suppliers, receipt of specimen-related label samples, stationary and rules and regulations for museums. The letter concluded with a description of the museum she had started to develop and available funds:

It's simply a big classroom, about as big as your workshop with shelves and tables. As yet, there is no workshop although it has been requested. Cases for study of skin collections, etc., are to be built, as well as exhibition cases to be located in the lobby of the Biology Building. Our staff is made up of a Director, Assistant Director, and an Assistant (a sort of clerk, janitor, all-in-one). For my publicity campaign, I have gone through all classrooms giving a pep talk on the newly created Museum. Our summer course ends this coming week and I thought it a good idea to let these students (who are mostly teachers in

service) know about the Museum so that they can help with their questions and probably [bring] specimens from various parts of the island. (Charleston Museum, 1944, par. 10-11)

Navarro-Haydon stepped down as Director of the MBS in 1945. Although the reason for her departure was not mentioned in any reviewed document, it is likely that Pedro A. Cebollero, Dean of the Faculty of Education, convinced Chancellor Benítez that she was needed back at the University on a full-time basis. It is also possible that Navarro-Haydon arranged to head the MBS for one-year period to train her replacement, Josefa Velázquez de Maceo. In 1947, Navarro-Haydon reached the rank of Associate Professor for the recently inaugurated Department of Methodology and Practice. Newspaper articles from the late 1940s describe the continuing work of the MBS under the direction of Velázquez de Maceo. A newspaper article from that decade (September 15th), reported that regular demonstration sessions were scheduled for students enrolled in the Introduction to *Biological Science* course at the *Biology College* (now, the Faculty of Natural Sciences) and the general public. It also described several donated specimens including: (a) A 5-foot constrictor pine snake from the *Pituophis melanoleucus*, species donated by the Bronx Zoo with mediation from Carlos Vélez Guevara; (b) a 5-legged frog of the *Bufo marinus* species (today known as *Rhinella marina*) donated by student, Emilio A Lafont; and (c) a preserved jellyfish donated by Mr. Agrait, Assistant to the Provost (Museo de Ciencias Biológicas, 1948).

Later that same month, another newspaper article describes MBS efforts to start a scientific library. The article described how former Department Chair, Dr. F. M. Pagán purchased metal shelves and other furniture and former faculty member, Dr. Roman Kenk's preparation of the library classification system. The Director mentioned that reprints and publications from the School of Tropical Medicine, the Agricultural Station, the University of Michigan, and personal collections from Dr. Evelina Ortiz and Ms. Raquel R. Dexter helped increase the library's holdings. The article requested support from the general public and UPRRP alumni for the MBS and its library by donating appropriate specimens and publications (*Ciencias Naturales*, September 30, 1948).

In April 1949, another article stated that more than 3,000 students had visited the MBS in the preceding 2 years (*Estudiantes de la Isla en Museo de Biología*, April 2, 1949), most on field trips with their classes and teachers. Visitors included groups of students from night schools, public and private high school, elementary and middle school and *second units* (rural schools). The majority of the students were from San Juan and Río Piedras. The article mentioned that MBS personnel could prepare special exhibits and lectures based on school requests. A few examples of these lectures included those by Dr. Frontera (vertebrate classification), Dr. Julio García (insects), Miss Cestero (invertebrates) and Ms. Porrata (protochordates). By the early 1950s, MBS activity, was unreported by the local university newspaper and no correspondence was found in the MBS Historical Archives. Dr. James Ackerman, current Director of the Natural History Museums, UPRRP, stated that he was unaware of the existence of the MBS before the 1960s:

I was surprised that we had a Natural History Museum in 1944-1945. We had thought that the Museum of Zoology began in the early 60s with the efforts of Drs. Manuel Vélez, Frank Rolle and Harold Heatwole, and the herbarium began with Dr. Michael Byer in the mid-60s. No zoological specimens have survived. Some plant material has survived, such as bryophytes collected by F. Pagan in the '30s, and some algae specimens collected for the Scientific Survey of Puerto Rico early in the 20th century and sent to us from the New York Botanical Garden prior to the establishment of the current herbarium. Therefore, there seems to be an information gap for museum activity from 1945 to the early 1960s. (J. Ackerman, personal communication, January 25, 2019).

NAVARRO-HAYDON: INTERNATIONALIZATION AND SCIENCE OUTREACH

During the 1950s, the work of Navarro-Haydon focused on three important areas: writing local science textbook series for elementary science (Figure 4), administrative and committee duties and collaborating with student organizations and clubs. Her scholarly publications include a booklet on birds (Navarro, 1950),

a peer-reviewed article (Navarro, 1959b) and the K-3 Science Curriculum for the Puerto Rico Department of Public Instruction (Navarro, 1959c). In 1956, Navarro-Haydon achieved the rank of tenured Professor.



FIGURE 4

Science Today and Tomorrow, part of the Our World elementary series.

Source: Cebollero & Navarro (1959).

Documents in her academic file showed that the planning of the *Nuestro Mundo* (Our World) textbook series in collaboration with Dr. Pedro Cebollero and Ginn & Co publishers, occurred in 1950. These textbooks were used years by the Puerto Rico Department of Public Instruction (Cebollero & Navarro, 1953, 1955, 1956, 1957, 1959). Navarro-Haydon also participated frequently in various committees to advise the Department of Public Instruction and the UPRRP Laboratory Schools (which included writing science curriculum). In 1955, she served in the Middle States Association Committee responsible for preparing a UPRRP accreditation report on Standards, Preparation and Teaching Load for faculty and collaborated in selecting artifacts and material to be displayed during UPRRP's 50th anniversary commemoration. From 1954-1956, Navarro-Haydon was asked to serve as Director of two Extramural Centers in Humacao (current UPR Humacao Campus), and Caguas (which no longer exists, probably due to the opening of an Extramural Center in nearby Cayey (current UPR Cayey Campus) in 1967).

Navarro-Haydon led a number of student-centered activities. She chaperoned groups of students during educational trips abroad, which former School Chancellor Benítez described as cultural and study trips sponsored by the University administration. On one such trip, for example, Navarro-Haydon and her

students visited New York, France, Spain, Italy, Switzerland, Germany, and The Netherlands during the summer of 1954 (University of Puerto Rico, 2016).

Navarro-Haydon also collaborated with various special interest groups, such as the Garden Club of Puerto Rico (which she founded in 1953), the Birds and Forests Club, and the UPR Geology Club (which she founded in the late 1950s and chaired for several years). The Geology Club was extremely active and collaborated with the Puerto Rico Geologic Society and other academic groups (Navarro and Turner, 1959). In a recent publication by the Puerto Rico Geological Society, Dr. Lorna Jaramillo, a geologist at UPRRP, referred to the significance of Prof. Navarro-Haydon's involvement in the UPR Geology Club:

The club met to discuss geology topics and promote public interest in geology and related disciplines. Members participated on monthly field trips ... some which focused on the San Sebastián Formation ..., erosion in the San Juan coastal zone, and trips with the Mayaguez (club) chapter led by legendary John D. Weaver. Some of the problems identified by [Prof. Navarro-Haydon] were very familiar, such as the absence of a meeting place or omitting geology as an important part of the Island's school curriculum. Other problems have been resolved. For example, we now have a large number of Puerto Rican geologists. We have good access to the literature on Caribbean geology and are interacting with younger generations. (Jaramillo, 2012, p. 8)

During the 1960s, Navarro-Haydon's professional impact on science education expanded internationally as she led workshops and conferences for science teachers, principals and school administrators in Guatemala, Dominican Republic, Mexico, Cuba, United States, and Colombia, which resulted in the publication of a monograph (Navarro, 1962a). In addition, Colombia and Venezuela adapted the *Our World* textbook series into *Maravillas de la Ciencia* (Marvels of Science), published by Editorial Norma (Cebollero & Navarro, 1963a, 1963b, 1963c, 1963d; Cebollero, Navarro, & Paez, 1963). Her effort to disseminate science included approximately twenty articles published in a monthly tourist guide book by the Puerto Rican Department of Economic Development. Navarro-Haydon's remarkable articles informed and educated tourists and Island residents about topics ranging from local birds, corals, geology, coquíes, sugarcane, coffee, and mollusks, fluorescent bays, pineapples, avocados and acerolas (Navarro, 1959d, 1960a, 1960b, 1960c, 1960d, 1960e, 1961a, 1961b, 1961c, 1961d, 1961e, 1962b, 1962c, 1962d, 1962e, 1963a, 1963b, 1963c, 1963d, 1963e, 1964).

Navarro-Haydon made significant contributions to Puerto Rico's Public School System, such as developing the science curriculum for grades 4-6 (Navarro, 1960f). She also translated a series of three U.S. textbooks from English into Spanish which were used by local schools (Blough & Morris, 1962; Morris, 1961; Morris, 1962) and published in peer-reviewed journals (Navarro, 1962f, 1963f, 1963g, 1968). University records reveal that Navarro-Haydon retired from UPRRP in 1966. Her final publication was an article about Puerto Rico geology published in *Temas de la Historia de Puerto Rico* (Alegria & Navarro, 1988).

CONCLUSION

The Americanization process of 1900-1930 is one of many reasons that the educational system in Puerto Rico uses, copies and adopts curriculum and instructional materials from the United States including translated science textbooks for use by Puerto Rican students (Cabán, 2002). The political relationship between Puerto Rico and the United States has truncated the development of a fully-contextualized Puerto Rican education system, discouraging efforts to adapt the public school system to Puerto Rican culture and reality. According to Eliza:

As a fundamental part of a political structure, the public school system serves the goals of that structure. Therefore, public instruction cannot remain neutral or isolated from the political ideals that are its reason of being ... In principle, the public school is politically oriented. In practice, it is a political act directed at conforming the citizens of the structures and values of the political state. (Eliza, 1989, p. 2)

Contributions made by educators during the 1930s, such as Rosa Navarro-Haydon led to the development of contextualized and locally relevant curricula. After a flourishing career, Navarro-Haydon's academic legacy includes hundreds of science teachers whom she trained, dozens of scientific publications and the development of science education – achievements considered to be timeless and still relevant, even today.

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