

The National School of Electricity and Early Technical Education in Peru

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The National School of Electricity was an ambitious educational program envisioned to foster the implementation of an electricity network in Peru in the early decades of the 20th century. By merging the programs of two entities (The School of Arts and Crafts and The School of Engineering) into one institution, the promoters of the National School of Electricity aimed to train future local experts and technicians in the most advanced techniques from the Global North. The analysis of interviews, press releases, and the work of its main promoter (Emilio F. Guarini), as well as other materials and resources, allows us to contend that the National School of Electricity exemplifies the structural social fissures that obstructed the country's modernization programs. Although the project did not come to fruition, it highlights certain aspects (and the limits) of technical education and institutional culture that privileged an aggressive technological modernization over Peruvian nationals' well-being, especially those in rural areas.

Keywords

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The advent of electricity in Latin America at the turn of the 20th century was approached with enthusiasm and perplexity by policymakers, experts, and the general population alike. Each group projected their own expectations of how they envisioned electricity to improve or affect their social and economic conditions. Consequently, over the past century, electricity claimed its place as one of the most powerful and disruptive forces in the region. It not only transformed urban life and rural areas with the same techno-utopian purpose, albeit with different outcomes. Historians have actively documented this transformative process in various cities and the remote hinterlands while studying such technology's interfraction with social groups (Altshuler & González, 1985; Bonfiglio, 1997; De Vecchi & De Vecchi, 1987). A new cohort of historians – trained in the intersection between historical analysis and Science and Technology Studies (STS) – is reshaping our understanding of this particular form of technoscience and its adoption in Latin America (Correa Gómez, 2014; Montaña, in press; Ragas, 2020; Soto Vejar & Sanhueza Cerda, 2020; Tafunell, 2011; Zacarías, in press).

This essay argues that the *Escuela Nacional de Electricidad* (National School of Electricity, henceforth NSE), promoted by Emilio F. Guarini, embodied the expectations of policymakers, technocrats, and students on how electricity might pave the way for Peru's economic development and technological modernization. Whereas engineers and other high-profile professionals are well-known, we aim to restore the role of obscured groups of experts – the technicians – and how they were trained. Even though the NSE was a project proposed by Guarini that never came to fruition, its failure does not make it less relevant or consequential as a subject of study. By approaching both the project itself and Guarini's obstacles to accomplishing its materialization, we can observe how local actors and interests supported modernization without the willingness to rethink professional privileges and social structures.

In the following sections, we examine how the NSE was modeled, the proposed structure of its curriculum, and why it was conceived despite the presence of two other competing entities: the *Escuela de Artes y Oficios* (the School of Arts and Crafts) and the *Escuela de Ingenieros* (the School of Engineers). By analyzing: (a) its comprehensive proposal and mission; (b) the group of students it was expected to receive and train; and (c) its teaching methods (i.e., excursions), this paper contends that the failure of the NSE marked the divergence between Engineering and technical education and its influence on future techno-scientific educational projects in Peru. We have put together interviews, newspaper reports, Guarini's writings, and other materials to investigate what was meant to be an innovative project in technical education and the social and institutional fractures that finally discouraged Guarini to implement it in Peru.

THE NATIONAL SCHOOL OF ELECTRICITY

Emilio F. Guarini arrived in Peru sometime in 1906 from Europe (probably Belgium). His presence responded to a national plan developed by the central government to promote 'national industry' through the formation of technicians in electricity ('La Enseñanza Técnica,' 1910). With technoscience deemed as an alternative to rapid and sustained development, especially in the aftermath of the war against Chile that devastated the country, inviting Guarini seemed an astute move in that direction. Although we do not know the details of the negotiation (or Guarini's previous professional trajectory in Europe), we do know that Guarini was approached in Brussels around April 1905 and invited to become part of the faculty of the novel School of Arts and Crafts.

To secure his presence, he signed a contract in advance with the government. Local newspaper articles published about him and his future projects in Peru caused controversy even before his arrival to South America. His vision of the countryside moved entirely by electricity certainly prompted local curiosity (Guarini, 1906a, 1906b, 1906c). Some faculty members, afraid of the foreign competitor and the early attention he was receiving before his arrival, rushed to clarify that Guarini "was not a member of the School of Engineering" ('Escuela Nacional de Electricidad. A Propósito del Sr. Guarini,' 1906). In reality, Guarini had a joint appointment as a professor of Physics and Electricity at the School of Arts and Crafts and as a Professor of Electrical Engineering at the School of Engineers.

By the time Mr. Guarini had settled in Peru, there were two institutions in charge of technical education in the country. The first was the School of Arts and Crafts. Created in Lima in 1864 and reorganized in 1903, the School of Arts and Crafts fostered the country's modernization by educating

future technicians in the mechanical arts. The new phase of the School of Arts and Crafts imposed a high standard of professionalization for its faculty and students. Besides Guarini, the school hired European instructors such as Mr. Paul Kampf from Germany to teach carpentry and Mr. Le Cerf from France to teach mechanics. Pedro Paulet, a renowned Peruvian engineer, was called to lead the institution. When Guarini joined the School of Arts and Crafts, its number of students had increased by threefold and it had fourteen workshops. The prominence gained in just a few years served as inspiration for two politicians to draft a bill seeking to create an educative professional model based on the renewed institution.

The School of Arts and Crafts' reopening was part of an ambitious educational reform launched by the national government in 1905. Jorge Polar, the Minister of Education, sought to prioritize practical training over liberal professions (Philosophy, Law, etc.) to incentivize economic development. For him, "without the support of labor and the strength that the exercise of labor provides to concepts, the word itself quickly loses substance and effectiveness" (Mac-Lean y Estenós, 1944, p. 345). Other prominent voices, like Alejandro Deustua, Manuel Vicente Villarán, and Francisco García Calderón, defended intellectual professions, paving the way for one of the most important debates on the nature of public education in the country. Given its well-established agenda, a robust faculty, and a solid reputation, Guarini considered the School of Arts and Crafts as an adequate space to promote his ideas. For him, the School of Arts and Crafts should be a first-level institution in Peru and South America. Therefore, he was committed to transform the institution into a platform to disseminate the latest advancements in the field through open talks to experts and lay individuals ('Sociedad Nacional de Agricultura,' 1907).

The other institution was the School of Engineers. Founded in 1876 by the first civilian President of Peru, the School was the flagship of a new era of technological advancement and economic development (Gootenberg, 1998; López Soria, 2012). The war against Chile three years later abruptly halted that era. Yet, the school continued training professionals for the economic recovery that followed the Chilean occupation of the territory between 1881 and 1883. The same year that Guarini planned to arrive to Peru, Eduardo de Habich – a prominent Polish engineer – announced a new section devoted to training electrical engineers. Guarini and Habich had been in touch before Guarini's arrival, so this should not have surprised him. His good relationship with Habich and with faculty member Juan Alberto Grieve was crucial for his plan to implement the NSE in the near future. Nonetheless, it is more likely that the school perceived the NSE as a project that would undermine its prestige.

Guarini's pragmatic spirit may have been alarmed when he noticed that two competing institutions were teaching similar content, which meant a duplication (if not a waste) of existing human and logistical resources. Hence his aim to create an educational institution like the NSE to centralize and optimize both infrastructure and faculty. Above all, Guarini envisioned the NSE as anticipating and incentivizing the expansion of the electrical network and electricity use in Peru. From his position as a professor at the School of Arts and Crafts, Guarini had started a public campaign in the press and organized public conferences to share his vision of an electrified country and the necessity of future local experts in the field. Like many of his future projects, the NSE was modeled after foreign institutions like the Electro-technic Institute located in Grenoble, France. According to him, the 'excellent method' displayed guaranteed that engineers and workers received the same education and training ('Escuela Nacional de Electricidad. La primera escuela de ese género en Sud-América,' 1906).

As a newcomer to South America – and especially to Peru –, Guarini was unaware that his project's primary obstacle was social and not logistical. To operate, the nascent NSE had to first reconcile the social and professional differences and rivalries between the School of Arts and Crafts and the School of Engineers. As we will explain in the next section, the opposite profile of students in both institutions hampered the prospect of the NSE from the very beginning. Guarini appealed to how a unified institution would solve logistical issues exhibited by the School of Arts and Crafts and the School of Engineers. As he explained, the facilities of the School of Engineers were too ample for the small number of students enrolled, which could, in turn, represent significant savings for the School of Arts and Crafts if they decided to build new classrooms. The NSE was designed to have an advanced research laboratory, which could also provide a significant income source. Another space in the proposed facility was intended to serve as a conference room, where "audience[s] and students, including ladies and misses," could enjoy topics on "electric science." ('Escuela Nacional de Electricidad. La primera escuela de ese género en Sud-América,' 1906).

Most importantly, the NSE sought to bridge the technical and social divide between 'workers' (technicians) and 'engineers' by providing the same education to both groups. His plan contemplated merging the section of Electricity and Electromechanics from the School of Arts and Crafts with the Electrical Engineering section at the School of Engineering. The shared facility and curriculum would then translate into a shared learning experience for students. For Guarini, "iron and steel should not be forged differently," by either a student from the School of Engineering or the School of Arts and

Crafts ('Escuela Nacional de Electricidad. La primera escuela de ese género en Sud-América,' 1906). The press applauded this effort since it could potentially improve the education of Mining and Civil Engineers and expand their training to serve critical areas, such as Agriculture and Industry ('Escuela Nacional de Electricidad. La primera escuela de ese género en Sud-América,' 1906). What was most problematic was establishing the NSE's autonomy or jurisdiction. Guarini was not entirely sure if the NSE would lie under the School of Arts and Crafts' authority or the School of Engineering. Since that was not an easy issue to solve, at least in the short term, he focused his efforts on building a proper environment for students.

THE STUDENTS

The NSE, as envisioned by Guarini, intended to provide the necessary logistical and financial resources to its potential students to fulfill a broader purpose: to promote national development through the implementation of electrification in the country. Hence, electricity should not only stimulate national industries but also prompt their competition with foreign electric companies ('Escuela Nacional de Electricidad. La primera escuela de ese género en Sud-América,' 1906).

The NSE was envisioned to train future technicians in a moment of aggressive national modernization. Artisanship had been declining since the late 19th century. Despite artisans being thought of as a potential part of the future modern labor force, liberals and authorities soon dismissed them as conservative agents, incapable of adapting to modern technologies (García-Bryce, 2004). The School of Arts and Crafts – where Guarini was hired as a Professor – had the mission of training a new generation of “laborious and honest” workers to operate in both national and foreign electrical companies (Reglamento de la Escuela de Artes y Oficios, 1864, p. 1). To fulfill this objective, the School of Arts and Crafts was free of charge and oriented at providing both theoretical and practical knowledge to its pupils. Being accepted at the School of Arts and Crafts meant achieving a special status and possessing a commitment to public service. It was expected that upon finishing the program, students would have nationwide workshops to expand technical knowledge. Given that the School of Arts and Crafts functioned as an internship, pupils received a monthly stipend in addition to food and clothing (Reglamento de la Escuela de Artes y Oficios, 1864, p. 8).

On the other hand, the School of Engineers sought to prioritize the training of professionals in Civil Construction, Mining Engineering, Mechanics and Electricity, and Architecture, among other careers (Decreto-Ley N° 7039. Estatuto de la Escuela de Ingenieros, 1931). Prospective national

students needed to have completed high school and passed the school's entrance exam. Foreigners and those applying from universities and technical schools from abroad were reviewed by a special commission to validate the courses already taken in their previous schools. In contrast to the School of Arts and Crafts, students at the School of Engineers were not interns, but they could receive a small stipend based on their grades. They also received a travel stipend to study abroad for two years and improve their training.

Guarini's educative project was influenced by the European *tecnicums*, while teaching methods were inspired by American technical education (Guarini, 1907b). Electro-technique (*Electro-técnica*) became the mandatory formative discipline for every engineering student at the School of Engineers, stressing its practical applications in industrial activities (Guarini, 1907b). Electro-technique was also an important course in other areas of the School of Engineers. A prominent professor like Santiago Antúnez de Mayolo became responsible for introducing students to its methods. This emphasis also reflected Guarini's view that every human activity was inextricably tied to electricity.

Additional coursework could include subjects such as Hydraulics and Hydraulic Machines, Electrical Measurements, Thermodynamics, Radio Engineering, and foreign languages like English and French (*Prospecto de la Escuela de Ingenieros*, n.d., pp. 20–21). The School of Engineers had fellowships for those who earned the highest grades. Most importantly, the School of Engineers also had solid connections with electric companies (i.e., W.R. Grace and Company and General Electric), which sponsored those scholarships while they looked to recruit the best talent from schools to work in their headquarters abroad (*Prospecto de la Escuela de Ingenieros*, n.d., p. 12). National corporations like public lightning companies in Tarma (in the central highlands), the Electric Light Society of Trujillo (in the Northern coast), the facilities of the Alpamina Mining Company, and even Grau and Bolognesi warships were also attractive spaces for teaching and potential workplaces for alumni ('Educación técnica industrial,' 1910). To train future competitive experts in electricity to fulfill these potential workplaces, students needed to embrace both theoretical and practical education. Guarini was interested in promoting outdoor excursions as an essential teaching method that would add to students' personal experiences.

EXCURSIONS

Excursions or *viajes de instrucción* were the method *par excellence* on how both technicians and engineers carried out fieldwork. Guarini deemed them "the most comprehensive and helpful element to developing personal initiative

and the spirit of observation” (1907a, p. 547). By traveling outside the capital city (and sometimes to other countries), students and future professionals had an experience that complemented what they had learned in classrooms, laboratories, and conference rooms. Whereas the School of Engineering received most government support, the School of Arts and Crafts also deemed it necessary to provide a comprehensive education to its pupils. Still, the Peruvian government invested large amounts of money in engineers and in 1909 it increased the sum for “expense trips for students and instructors” (Ley N° 990, 1909). Restrained by its few monetary resources except for some support mainly from private firms, the *Escuela* managed to provide a similar experience to their students. Guarini was committed to including an annual trip for the *Escuela’s* students no matter the financial cost.

During his tenure as faculty at the *Escuela*, Guarini organized and carried out two trips with his students. Both excursions took place during the summers (January-March) of 1907 and 1908. They lasted from a few weeks to a couple of months with the Southern Peruvian highlands as their main destination (‘El Regreso de La Comisión de Electricistas de La Escuela de Artes y Oficios,’ 1908). The trips covered an extensive area in the Southern highlands and near coastal areas, including Bolivia. Guarini and his students visited isolated villages, maritime ports, mining companies, and rural estates. Guarini revealed himself to be an astute observer of the territory and left his comments in a lengthy narration published as *El Porvenir de la industria eléctrica en el Perú* (1907a). As part of his commitment to connecting the School of Arts and Crafts with a broader audience, Guarini presented a summary of one of the excursions at a conference held just a few days after returning to the capital city.

Even if the students came from other regions, the excursions were consequential life experiences for them. Guarini’s writings and descriptions of the excursions offer a comprehensive account of the state of mining and agriculture and the prospects for the implementation of electricity (Guarini, 1907a). Guarini’s optimism was rapidly confronted by severely damaged roads and local inhabitant’s material conditions. His opinion of the rural population was negative. For him, the Indigenous population represented an obstacle to his vision of progress and full electrification of the highlands (‘El Perú en Alemania,’ 1909). They were opposed to technology, and Guarini did not mention any possibility of them becoming potential users of electrical devices. In a moment where racism was at the peak of the national discourse, his comments and remarks passed unnoticed among many other policymakers and technocrats, who were even less sympathetic toward Andean peasants (Guarini, 1907a, pp. 573 y 583; Kristal, 1991; Marcone, 1995).

The excursions accomplished two intertwined objectives. First, they were a first-hand experience for future technicians. Guarini was convinced that both national and international trips should complement the School of Arts and Crafts' theoretical education in Lima. On their trips, students were exposed to various environments and social conditions. They experienced multiple social, cultural, and technological contrasts in some of the country's poorest and most underdeveloped areas. Moreover, students were not simple observers since their role demanded installing and repairing electric machinery, based on their previous lessons at the *Escuela*. Furthermore, they were responsible for adapting the equipment to the region's changing conditions while operating those instruments at high altitudes and in adverse climates.

A second objective was to introduce students to potential employers during those excursions. For Guarini and the emergent technocratic Peruvian elite, the *Escuela* and the School of Engineering needed to focus resources on improving the highlands mining and rural production. Most of the mining centers and rural estate owners hired their own technicians, some of them foreigners. With the excursions, Guarini attempted to minimize potential resistance from students to move beyond coastal areas and install themselves in mining camps or rural towns. Local investors and transnational corporations such as W.R. Grace and Company were enthusiastic about hosting the students and sharing their plans with them.

The excursions were funded with a combination of the School of Arts and Craft's financial resources, public resources, and private donations. These resources allowed Guarini and his students to overcome the usual financial constraints of the institution. The group was received and hosted at every place they visited by mine and rural estate owners. The press was supportive of these trips and announced the group's return as triumphal events ('Viaje de instrucción de los alumnos electricistas,' 1907). In the end, they became one of the most visible activities the School of Arts and Crafts shared in the public sphere. The media coverage of the excursions portrayed the School of Arts and Crafts as a first-class educational institution. The public applauded the lengthy trips to the highlands and the coastal areas and contributed to consolidating Guarini's adventurous spirit.

EPILOGUE

In March 1911, *El Comercio* published a farewell letter sent by Guarini to Peruvian authorities, announcing his desire to install himself in Panamá. Guarini had been commissioned by the government of Panamá to reorganize the local *Escuela de Artes y Oficios* and to implement a national industrial school – the

first of its kind – in the new country ('El profesor Guarini funda la Escuela de Panamá,' 1911). Like he did in Lima, he conjured the experience of the European *tecnicums* as the inspiration for future establishments. Furthermore, he invited seven students from the first cohort of the School of Arts and Crafts in Lima to join him in the Panamanian project as faculty members. The future educative institution was praised in local newspapers, with similar compliments as those given by the Peruvian media a few years before.

The offering of the Panamanian government and the opening of the Electromechanic section at the School of Engineering in Lima in 1912 canceled the project to create a unified institution – the NSE – as Guarini had envisioned. In his farewell letter, he expressed his disappointment with the obstacles encountered during his tenure in Peru, marking the end of his presence in the country. Writing from 'voluntary exile,' Guarini summarized his Peruvian experience as 'sterile' after six years in the Andean country ('El profesor Guarini Funda la Escuela de Panamá,' 1911).

CONCLUSION

As we have demonstrated, Guarini did not anticipate that an institution like the NSE was a risky move for the Peruvian social and academic environment. The NSE remains a significant yet obscure example of the problematic implementation of modernization projects through public technical education in the country. Despite an auspicious reopening of the School of Arts and Crafts in 1903 and the search for foreign instructors like Guarini, Habich, and many others to train local pupils, the project could not overcome the social fractures that pervaded scientific institutions. Furthermore, the training itself reproduced such fractures by conceiving technology as an instrument to promote economic activities rather than elevating living conditions at the highlands, as the excursions revealed.

The controversies around the NSE anticipated some other significant debates in the 1920s about the role of public education in fostering autonomous national development. In his seminal *Siete ensayos de interpretación de la realidad peruana* (*Seven Interpretative Essays on Peruvian Reality*), published in 1928, Socialist intellectual José Carlos Mariátegui framed the tension between technical and liberal education as a major divide in the history of the country. By linking 'liberal education' with the 'old rural aristocracy' and 'Spanish heritage,' he deemed technical and practical education – like the one imparted in the NSE – as a liberation tool for the oppressed masses (Mariátegui, 1928, chap. 4).

Guarini's absence from Peru and his estrangement from the School of Arts and Crafts did not stop Peruvian policymakers from estab-

lishing other ambitious projects for implementing electricity in the country. Whereas the government and the technocratic elite focused their efforts on dams and urban electric networks, technicians and technical education struggled to navigate through official abandonment, lack of public commitment, and declining educational budgets in the following years. The once-promising project of recruiting and training a creative and local group of technicians was never reprised for the remainder of the century. □

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