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"This Computer Came to Do a Job": A Socio-Material Analysis of the Enactment of Innovation Policies in a Technical School in Buenos Aires City, Argentina

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Abstract: This article utilizes the language of the Actor-Network-Theory (ANT) to examine policies of educational innovation as effects of socio-material aggregation. Identifies, describes and analyzes activities from human and non-human actors which alter the central aspects of schooling within a technical education institute of the Autonomous City of Buenos Aires at the

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end of the 1990s and early 2000s. These actions cast doubt upon the workshop, a practical area that distinguishes this kind of educational institution from a regular high school, and thus challenge the very concept of a proper technical school and a *good teacher*. Following Ball (1993) and Fenwick & Edwards (2010), we described material, pedagogical and socio-labor transformations and innovations of the workshop, and traced the (non anticipated) association between people, institutions, tools, technology and the perspectives which fuel them. This analysis is based around a qualitative study that counted with participant observation, interviews with educators, and analysis of documentation. This contributes to the study of educational policy examining not only practices and meanings, but also materiality and its performance—a marginalized aspect in the field of educational investigation in Argentina.
Key words: socio-material association; innovation; educational policy; technical high school; Argentina

"Esta computadora vino a hacer un trabajo": Un análisis socio-material de la puesta en acto de políticas de innovación en una escuela técnica en la Ciudad Autónoma de Buenos Aires, Argentina

Resumen: Este artículo utiliza el lenguaje de la Teoría del Actor-Red para examinar políticas de innovación educativa como efectos de acciones de ensamblajes socio-materiales. Identifica, describe y analiza acciones de actantes humanos y no humanos que alteraron aspectos centrales de la escolarización en un establecimiento de educación técnica de la Ciudad Autónoma de Buenos Aires, a fines de la década de los '90 y principios de los 2000. Estas acciones pusieron en cuestión al taller—espacio que distingue a esta modalidad educativa respecto de las secundarias comunes—y con ello disputaron los significados en torno a cómo debería ser una escuela técnica y un *buen docente*. Siguiendo a Ball (1993) y a Fenwick & Edwards (2010), describimos transformaciones e innovaciones materiales, pedagógicas y socio-laborales del taller, y rastreamos la asociación (no anticipada) entre personas, instituciones, herramientas, tecnologías y perspectivas que las motorizaron. Este análisis se basa en un estudio cualitativo que incluyó observaciones participantes, entrevistas a docentes y análisis de documentos. Contribuye al estudio de las políticas educativas examinando no solo prácticas y significados, sino también materialidades y su carácter performativo—aspecto que ha tendido a ser marginalizado en el campo de la investigación educativo en Argentina.
Palabras claves: asociación socio-material; innovaciones; política educativa; escuela secundaria técnica; Argentina

"Este computador veio para fazer um trabalho": Uma análise socio-material da implementação de políticas de inovação numa escola técnica na Cidade Autónoma de Buenos Aires, Argentina

Resumo: Este artigo utiliza a linguagem da Teoria do Actor-Rede para examinar as políticas de inovação educacional como efeitos de acções de assemblage sócio-material. Identifica, descreve e analisa acções de actores humanos e não humanos que alteraram aspectos centrais da escolaridade num estabelecimento de ensino técnico na Cidade Autónoma de Buenos Aires no final dos anos 90 e início dos anos 2000. Estas acções puseram em causa o workshop - um espaço que distingue esta modalidade educativa das escolas secundárias regulares - e, assim, contestaram o significado de como deve ser uma escola técnica e um bom professor. Após Ball (1993) e Fenwick & Edwards (2010), descrevemos as transformações e inovações materiais, pedagógicas e sociolaborais no workshop, e traçamos a associação (inesperada) entre pessoas, instituições, ferramentas, tecnologias e perspectivas que as impulsionaram. Esta análise é baseada num estudo qualitativo que incluiu observações dos participantes, entrevistas a professores e análise de documentos. Contribui para o estudo das políticas educativas ao examinar não só práticas e significados, mas também materialidades e o seu carácter performativo—um aspecto que tendeu a ser marginalizado no campo da investigação educativa na Argentina.

Palavras-chave: parceria sócio-material; inovações; política educativa; escola secundária técnica; Argentina

"This Computer Came to Do a Job": A Socio-Material analysis of the Enactment of Innovation Policies in a Technical School in Buenos Aires City, Argentina

During the last two and a half decades, the quantity of research focusing on the educational policies at the secondary school level in Argentina have grown considerably. This proliferation can be attributed to changes in standards (Federal Education Law of 1993 and National Education Law of 2006) that reorganized central aspects of schooling, such as the form of government, organization and length of the school levels and compulsory school years. A large part of these focused upon the programs and social and educational policies targeted on increasing the effectiveness of the universality of the secondary school and the educational inclusion on said level. Amongst all these studies, we find research regarding educational strategies and programs with the intention of realizing the right to an education within a context of inequity[1]; new institutional arrangements and devices that challenge modern schooling[2]; and social programs and their impact upon secondary schooling[3]. On the matter of technical education, few works examine the policies specifically aimed at this category. Highlighted amongst these are the studies regarding the Technical-Professional Education Law N°26058, which includes both a mapping of the actors, enunciates, arguments and logic that underlie this policy (Almandoz, 2010), like an analysis of its implementation (Cordero & Bucci, 2011; Maturo, 2018); the ones which address education and technical formation policies in Argentina, Brazil and Colombia, framed by the creation of national systems of qualification (Briasco, 2017) and others that deal with internships or professionalized training in different provinces (Garino et al., 2021; Jacinto & Dursi, 2010). Now, beyond specifics, most of these researches have examined the enactment of the policies paying heed to the meanings, appropriations and recontextualization of the rules and programs (of national or jurisdictional reach) that have sought to orientate the practices and meanings of school life.

This article subscribes to the tradition of the studies of the Actor-Network Theory (ANT) and focuses on the role of materiality in the production of educational policies. This perspective aims to bring to attention the actions of complex networks of human and non-human actors that, following Ball et al. (2012) and Fenwick & Edwards (2010), shape educational policy. This approach has been highly prolific among English and French-speaking researchers, but it is still relatively underutilized to examine educational policies at the secondary level in Latin America[4]. Following ANT, our analysis pays attention both to the practices of a group of

[1] For example studies regarding the *Plan de Mejora Institucional* (Institutional Improvement Plan) and its execution in various provinces (Dirié et al, 2012; Montesinos & Schoo, 2014), the *Plan Conectar Igualdad* (Equality Networking Plan) focused on the integration of IT in schools (Lago Martínez et al., 2012; Tedesco et al., 2017); and the process of implementation of the Educación Sexual Integral (Policy of Sexual Education) in Argentina (Faur, 2018; Faur et al., 2015).

[2] Refer to studies on the *re-entry schools* (schools focused on teens with interrupted or halted schooling) in the City of Buenos Aires (Baquero et al., 2009; Meo, 2015; Meo et al., 2014; Nobile & Arroyo, 2015;), the schooling centers for teens and young adults (CESAJ; Krichesky, 2014; Toscano et al., 2012) and about PROA (Programa Avanzado en Educación or Advanced Program on Education) schools in Cordoba and the Highschool of the Future in the City of Buenos Aires (Landau et al., 2019; Steinberg et al., 2019).

[3] Refer to works on *Asignación Universal por Hijo* (Gluz & Rodríguez Moyano, 2013) y *becas estudiantiles* (Finnegan et al., 2012; Stuart Milne, 2012.

[4] In Argentina we identify López et al. (2019) that examines the policies of coexistence within the school in Argentina and Chile; Paredes Suzarte (2015) regarding the PISA tests within these countries, and

teachers and to the performative capacity of concepts and ideas as well as the actions of objects and machinery (Latour, 2008). In particular, we are interested in tracing how these diverse elements become associated and, in doing so, participate in disputes surrounding the meaning of "technical school" and what constitutes a *good teacher* - reorganizing central aspects of teaching in the electrical and electronic specialities within a school in the Autonomous City of Buenos Aires (CABA in Spanish language). These symbolic, social and material disputes are linked to broader ones. Among these; those related to the purpose and organization of the secondary level, the type of relationships that should exist between the schools and the productive world, and the desirable modes of economic, productive and technological development for our country.

To this end, we will describe the actions carried out by a socio-material network of human and non-human actors that, in connection with a set of phenomena and processes extending beyond the school and the educational realm, between the mid-1990s and averaging the second decade of this century, questioned and innovated the logics that organized the workshop, a material, pedagogical and socio-labor space that, in Argentina, distinguishes this modality from regular schooling.

This article is organized into three sections. In the first instance we present key aspects of the epistemological, theoretical and methodological approach of ANT, as well as its connection with the perspective of enacting educational policy (Ball, 1993; Ball et al., 2012). Following that, we include the research questions and the methodological strategy. Finally we expand upon two sections the mark of both *questioning* and *destabilizing* actions, as well as as *innovations*, carried out by a socio-material network of human and non-human actors at the Illustrious Argentine Technical School (*Escuela Técnica Prócer Argentino* or ETPA), from the mid-1990s to the mid-2010s. To do this, following ANT, we will describe the ability of this assemblage to pull and promote actions that transformed the workshop, mobilizing elements of material, discursive and symbolic nature, both local and global, contemporary and from the past. Among them, on one hand the notion of a "traditional technical school"[5] and of "outdated," "obsolete," and "symbolic" objects that represented it, and on the other hand, the representation that was being produced of a different technical school -on capable of teaching valuable and "real" industrial production methods- associated with "new" and "cutting-edge" objects resulting from "technological advancements."

ANT as a Toolbox

As different studies point out (Fenwick & Edwards, 2012; Law, 2009; Mol, 2010), the ANT is an approach that allows the tracking of heterogeneous and precarious, such dimensions and actors which are marginalized in dominant sociological analysis, as is the case of objects. Here we resume some definitions to recover a vocabulary that allows us to analyze the symbolic and material disputes that were part of the enactment of educational policy in a technical school in the City of Buenos Aires.

In the first place, we point out ANT, in opposition to sociological common sense that postulates existence of an explanatory framework for social actions, aims to understand how assemblies and associations are formed between human and non-human actors which form the social part (Latour, 2008). These socio-material networks express processes extended in time and space, more or less stable, that in general hide their precarious state and the constant effort their members do for holding them (Dussel, 2018).

Dussel (2015) for the educational program of digital inclusion "*Conectar Igualdad*". In Uruguay the work of Da Silva Ramos & López Gallego (2014) about the Ceibal Plan.

[5] In this study we will make use of quotation marks for expressions used by different people during our fieldwork, while italics will be used for concepts taken from other authors or as ways of naming defined in dialogue by empirical evidence as well as a way of remarking untranslated terms and names in the text.

From this perspective, concepts frequently used in educational research, such as academic regime, format, and school culture, rather than being self-evident notions of how pedagogical practice is organized, refer to stable effects of a complex, *dislocated*, and distributed collective work driven by various types of human and non-human actors (Beech & Artopoulos, 2016; Dussel, 2013). In our study, what teachers defined as a "traditional" technical school - which was perceived as a self-evident reality and seemingly unalterable by many of their colleagues- was the outcome of the joint action of multiple elements, actions, objects, times, and spaces that remained opaque, invisible, and silent for decades (Correa Moreira, 2012; Latour, 2001). However, there are historical moments, like the one analyzed in this article, in which certain notions -such as that of a technical school and the concept of a skilled electrical and electronics teacher in our case- are questioned to the point of becoming subjects of dispute. In these scenarios, some human actors begin to defamiliarize themselves from established norms, "*deblackboxing"* (Latour, 2001) the assemblage they were part of. By doing so, they recognize associations between human and non-human actors and even the effects of their actions, which until then appeared to them as compressed, like a *black box* or *fold*. Following Latour, we understand that ANT is useful for analyzing these moments when associations are denaturalized, and new, unanticipated or unorchestrated associations begin to emerge, leading to transformations and innovations by establishing new practices and meanings (Latour, 2008).

In this sense, we conceive teaching and the work of educators not as inherent individual properties -like a knowledge one *possesses or applies*, respectively -nor as merely social practice- like something *done* with other humans -but rather as an effect, susceptible to change, of the ongoing interaction between human and other types of actors (McGregor, 2004; Nespor, 2012). The analytical task then becomes the "tracing of associations" (Latour, 2008, p. 13) that these heterogeneous actors forge in order to identify how they assemble at different moments of stabilization, denaturalization, or transformation. Therefore, in this article, we explore traces of a new association by elucidating the mutual affinities (*interessement* in Latour's terms) among a group of educators, representations, institutions, and objects in their formation.

Secondly, this focus on actors of different types, following the vocabulary introduced by ANT, aligns with a principle of symmetry, which postulates the ontological equivalence of all entities composing the network (Beech & Artopoulos, 2016; Latour, 2008). This implies treating the diverse elements within an assemblage with the same "dignity," whether they are human or otherwise. Building upon this premise, in the present study, we observe how representations of technical education and objects relevant to educators in the workshop environment co-produce, through their association with other actors, pedagogical action and teaching work, consequently shaping educational policy.

However, this ontological equality of all actors doesn't necessarily imply equivalence in terms of their actions within the network. Latour (2008) distinguishes between *intermediaries*, entities that transport information without producing changes that alter the functioning and effects of a network, and *mediators*, those that, at a certain moment, modify and transform established meanings. The position of intermediary or mediator is not inherent to each actor or set of actors; it's defined based on the network it is part of. In this study, we argue that educators who, for a significant part of their professional trajectory, acted as intermediaries within the socio-material network they themselves define as the "traditional technical school," since the late 1990s have participated—in various forms, intensities, and roles—as mediators in the production of an association aimed at innovating secondary vocational education.

For associations that give rise to a socio-material network to materialize, what is known in the vocabulary of ANT as *translation* must take place (Latour, 2001). Translation is a process through which various entities, coexisting or not in space and time, shift and connect with each other. Translation refers to the work and forms of impact that different entities exert on one another in order to form an assemblage. The collective nature of any translation, which only

makes sense within an association with others, implies that it always involves a process of *inter-translation* (Corcuff, 2014).

In summary, we employ the concepts provided by ANT to enhance the definition of educational policy as an *enactment*, i.e., as creative, everyday, local practices that recontextualize and redefine policy texts or documents -such as regulations, programs, plans, among others (Ball et al., 2012). Following Fenwick & Edwards (2010), we understand that the study of educational policy as an enactment must examine not only the meanings, representations, and practices of human actors but also recognize their associations with non-human actors, as well as their respective interests and the specific ways in which their associations fold together different times and spaces (integrating notions, objects, and technologies created in various places and historical moments). We are interested in comprehending how educational policy is established within -and is a product of -an articulation, always unstable and contingent, between actors of different types, where humans are entities with varying degrees of agency and influence, yet not necessarily determinants or central in that assemblage (Latour, 2008). This is why in this article, we pay attention to how representations and objects—like a computer—in their articulation with a group of educators, companies, regulations, and other elements, are central to the production of educational policy.

Our Study and Research Questions

The analysis of the results is part of a qualitative research study on the process of social construction of the teachers' labor identities[6]. Our fieldwork was conducted in an "inclusive" technical school established in 2015 and affiliated with a national university. This school was regarded by its administrators and educators as "foundational," "innovative," and aimed at achieving something "unthinkable" in "traditional technical schools": ensuring quality education while also supporting the educational paths of all its students.

In the first two years of our research, we encountered four male teachers from the departments of electricity and electronics (one of whom would later become their coordinator). With them, until the end of 2019, Analía Inés Meo conducted spontaneous interviews, in-depth interviews, and photograph provocations. She participated in work meetings, institutional events, classes, breaks, and school ceremonies, took photographs of their classes and the objects they used.

During these encounters, the teachers compared and contrasted their ways of relating to and working with colleagues, students, and authorities in this "new" institution, with those prevalent in ETPA, which they defined as a prototype of what they termed a "traditional technical school." These teachers had to leave ETPA at the conclusion of the educational innovation process analyzed in this article (at different times and in different ways for each case). Their accounts and photographs, pertaining to both their past and present work experiences, referred to a wide variety of objects and technologies -such as CNC machines, automation systems, lathes, milling machines, computers, Ethernet, batteries, files, etc., while also touching on "conflicts," "internal struggles," and disputes over the meaning of the technical school and the ways of teaching and understanding the responsibility of teachers for their students' performance. According to these teachers, these "conflicts" started in the 1990s and continued up to the present. They believed that their work at the New Technical School was connected to an extension of these "internal struggles" and "battles," where differing perspectives on the technical modality and its connection to the socio-productive world were being contested.

[6] Partially funded by the UBACyT project 20020170100524BA. The research team includes: Analía I. Meo (director), Valeria Dabenigno (co-director), Mariano Chervin, Lara Ailén Encinas, Álvaro Rubiano Martínez, Joaquín Streger, and Ana Tauil.

Considering these disputes fostered by the teachers, the analytical-interpretive questions that guided our analysis were: What human and non-human elements of this new socio-material network contested and sought to innovate established ways of understanding and organizing the technical school and teaching work? And how did these entities become associated within the school? Following Latour and to address these questions, we chose to trace associations among a group of non-human actors—both representations and objects—with humans—this group of teachers—aiming to uncover traces of their collective actions, innovations, and approaches to educational policy-making in situated scenarios (though with global connections that extend beyond the school and educational realm). To do so, we formulated specific descriptive questions: When and how were innovative artifacts introduced to ETPA? Who was responsible for their introduction? How and where were they adopted and valued? Where and when were they not? What actions did these objects enable, and what did they compel? How did they differ from other objects that the same teachers labeled as "obsolete"? And in what other places, spaces, human and non-human agents were the introduction of "new technology" into ETPA during the analyzed period linked with?

To address these questions, we conducted thematic analysis of various sources, including: i) four photograph-provocation interviews and 45 spontaneous interviews (both individual and group encounters in classrooms, events, and hallways) with the teachers we met at the New Technical School; ii) 75 photographs taken by the teachers; iii) five interviews with key informants from different technical schools who helped us understand the historical process of dispute regarding the meaning of technical schools in CABA; and iv) both school-related and non-school-related documents (such as curriculum plans, curricular designs, blogs produced at ETPA, websites of companies, national and international professional associations of technicians, and official educational agencies in the technical field).

In the following section, we focus on various objects that allow us to trace processes of association between human and non-human actors that began to unfold in the late 1990s, aiming to challenge established meanings within technical education.

New Objects, Old Objects: Tracing Actors and Disputes Regarding the Meaning of Technical Education and Teaching Work

> By the late 1990s, "the computer had to be in the workshop," but they wanted it in the office for administrative tasks (...) that was the beginning of the internal conflict, the struggle" (Interview with Néstor, teacher and coordinator).

With the aim of reconstructing part of the process through which, in this case, established ways of organizing teaching, work, and workshop space and time were questioned—to the extent of articulating an alternative network-we will organize the analysis into two parts. The first part will describe how, stemming from the questioning of the role certain objects held in technical education, disputes emerged between opposing views on teaching and criteria for selecting curriculum content (thus impacting the material, pedagogical, and labor space of the workshop). The second section will detail the incorporation of the computer in ETPA's workshop, its centrality in consolidating the association between human and non-human actors, and the collective actions' effects in redefining teaching and technical work.

"We Had to Get Rid of Everything": Destabilizing Established Practices and Meanings

The reminiscence prompted by this Figure 1 illustrates how Néstor and other teachers in the technical area began to question what was being taught in the electrical specialty by identifying certain objects as "useless":

> "This space is the electrical workshop, for the upper cycle electrical specialty, with very few students, and very little equipment (...) practically with nothing. At this moment, it's already organized. (...) when I joined in '95, which was when I started in this area of the school, what we had to do was throw everything away because everything was useless, and we kept that equipment" (Interview with Néstor, teacher and coordinator).

Figure 1

Industrial Electrical Control Panel

Source: Néstor (1995).

In this quote, Néstor shares how the workshop looked when he took on new responsibilities as the teacher in charge of Electrical Installations for the "Electrician with a focus on industrial electronics" program at ETPA. From his perspective, this focus was very new and aimed to update or "give a new face" to the traditional electrician in response to the growth of "electronics and the advancement of the electronic technician" in the 1980s. It was from that historical moment that the material integration of electronic devices into electrical equipment and installations began to take place. According to Néstor and Roberto, another teacher in the electrical specialty (which originated with the technical school and has been offered by ETPA since its establishment in 1942), with this technological change, it became impossible to think about "pure electricity" and an electrician who could be ignorant of electronics. Historically, the professional profile of the electrician was focused solely on understanding how to generate and distribute electrical energy and how the equipment and installations related to those tasks operated.

In Argentina, starting from the 1990s, this technological change and the automation enabled by "programmable logic" began to alter production processes in certain industries linked to the international market, such as the automotive industry[7]. In this case, for example, the diffusion of these new technological developments was made possible by various factors: i) the enactment of the Convertibility Law, which established a stable and equivalent relationship between the local currency (the peso) and the dollar, promoting temporary price stability that

[7] En países centrales la adopción de estas tecnologías tuvo lugar en década de 1970.

favored credit and the growth of the automotive industry and the economy in general; ii) policies to promote the production of "state-of-the-art" automobiles and the establishment of new foreign companies; and iii) the consolidation of Mercosur and its effect on expanding the market size for Argentine companies (Barbero & Motta, 2007).

In spite of these technological, productive, and social transformations, at ETPA, electricity and electronics—by the late 1990s—were still being taught as if they were "watertight compartments," when, according to Néstor, they should have been taught "in an integrated manner." The incorporation of electronics into the technical school was seen by many "older" teachers, according to Néstor and his colleagues, as a "threat" to their job stability. When Néstor began working in the upper cycle, he set out to integrate knowledge and experiences in this area. He did this, for instance, by inviting an older electrician teacher who was "innovative" in terms of what he taught, and a younger electronics teacher, to "work together," to "share spaces and tools," even without a clear understanding at that moment of how they should go about it.

In the previous quote, Néstor talked about "useless" objects that he had to "get rid of," such as "contactors, switches, measuring instruments, lamps, electric motors, equipment for winding electric machines" (Néstor's writing, July 2020). For him, "getting rid of" didn't just mean "disconnecting from objects, but also from the way those objects were used for teaching." "Getting rid of" objects was a way to challenge established ways of defining the content to be taught and ways of understanding teaching work in the field of electricity and electronics. It was also a way to start building an alternative and to operate a translation that would allow for new, valuable learning experiences according to the teachers.

For Néstor, even the electrical control panel[8] shown in the image was considered "obsolete" since it operated using "wired logic" to control electric motors. At that time, students would design control systems on paper and then "move to the control panel - where they would make the necessary connections and verify the design of the automation - and apply techniques of assembly, connection, and electrical measurements" manually. As we saw, this technology was beginning to be replaced in many industries in Argentina by machines that operated with "programmable logic" to automate processes. Despite this, since they practically had "nothing" at that time, Néstor and his colleagues chose to adapt this control panel using other "electrical components" to update it. In his words, "it wasn't ideal, but we didn't have anything else."

Another example of these ways of understanding established pedagogical practices and forms of work that operated in the workshop at that time can be found in the account of Roberto, an electricity teacher. He points out the persistence in using outdated content and obsolete objects in the teaching of electricity at ETPA in the mid-2000s.

> It was obsolete to wind a transformer, (…) it was a total waste of time (…) you'd spend two months turning a little handle winding copper wire (…) nowadays, any person, any technician, if I have to make a transformer no matter how rare, it's more cost-effective to have it made, in terms of cost-benefit (…) It's absurd, even though it's good for the student to know how to calculate a transformer and that's it, because everything changes (…) doing a complex transformer calculation takes (…) five or six letter-sized pages of calculations, it's days of work, days of revisions (…) it's much more accurate to use software. (…) So, let's say that in electricity, and in technical sciences, progress was very significant and rapid. We can't linger on explaining obsolete things that the students won't use.

In Roberto's account, he discusses how certain practices in teaching the electrical course became outdated and inefficient. He points out that even though it's important for students to learn the basics of transformer calculations, modern technology and software have made many of these

[8] This object was donated by a privatized communications company during that time (ENTEL), which, according to Néstor, "sent all that junk to the technical schools."

manual practices obsolete and time-consuming. The rapid advancement in technical fields has led to a preference for using more efficient methods, like computer programs, rather than labor-intensive manual processes.

Here, Roberto illustrates, on the one hand, how outdated knowledge, skills, and bodily dispositions continued to be taught for the training of technicians – deemed outdated and useless by these teachers in the context of globalization and the automation of production processes through programmable logic in various industries. This type of content was established by the curriculum of the National Technical Education Council (CONET) in 1959 and remained in place even after the dissolution of this organization in 1993. On the other hand, this quote also highlights how the new socio-material association being formed allowed for distancing and defamiliarization from what the teachers referred to as the "traditional technical school," which, in many cases, continued to shape meanings and practices in technical schools.

According to the Actor-Network Theory (ANT), we understand that the notion of the "traditional technical school" held by the teachers operated as a significant actor in the emergence of this new socio-material network. This notion prompted actions that intervened in the workshop space, value judgments, and even emotions (such as the anger and frustration expressed by the teachers in the face of practices they deemed "aberrant"). The teachers interpreted the "traditional technical school" as a *black box* (Latour, 2008) that needed to be destabilized, questioned, and transformed in order to bring about a "revolution."

The notion of the "traditional technical school" referred by the teachers, was related to a form of schooling that corresponded to a model established in the second half of the 20th century in Argentina under the administration of the former CONET (National Technical Education Council), which was responsible for managing all technical schools. Despite the dissolution of this organization during the '90s due to educational decentralization and the technological transformations mentioned earlier that impacted industrial processes in recent decades, these teachers identified the persistence of certain teaching methods, curriculum content, and specific workshop practices that they believed were outdated and needed to be transformed. In other words, the "traditional technical school" wasn't associated with a distant past but rather with configurations of meanings that continued to shape modes of work, pedagogical practices, and curriculum choices. Following the accounts of the teachers, as well as historical and sociological analyses of this educational approach, the concept of the "traditional technical school" referred to established ways of teaching and understanding the "good teacher"—the ideal teacher—which we will further characterize (Gallart, 2006; Silva, 2006).

Firstly, the division between "theoretical" and "workshop" education was—and in many cases still is—a distinctive feature of technical education. According to teachers, key informants, and studies on the subject, the learning in "theoretical" subjects rarely translated into solving concrete "practical" problems encountered in the workshop. In this context, the role of teachers was to guide students in the "execution" of "correct work procedures" and the acquisition of "psychomotor skills" (Silva, 2006). For the teachers in this study, bridging these "two worlds" required students to possess a significant level of abstract thinking, a demand that many students struggled to meet, contributing to high dropout rates (technical education has some of the highest dropout rates at the secondary level). The separation between contents and the methods of knowledge transmission also manifested in how these areas were temporally and spatially organized (Gallart, 2006). "Theory" and "workshop" subjects often took place at different times, without overlapping. Additionally, these areas were housed in separate buildings with distinct architectural features. While the "workshop" space, with its sections for different specialties, tools, equipment, and designated areas for workshop leaders, mimicked industrial settings; the "theory" space was taught in conventional classrooms with rows of desks, chairs, and blackboards.

Secondly, the notion of the "traditional technical school" refers to the individual teaching work of educators—both in theory classrooms and workshops—disconnected from the rest of

subjects, knowledge areas, and colleagues, and focused on teaching the same content to all students. This individual teaching approach by teachers assumed and solidified within a school divided into sections separated by gates, walls, locks, and keys. Even at the beginning of the 2000s, at ETPA, despite the desires for change from several teachers and their attempts to integrate sections, divided classrooms and cabinets where some teachers kept what "belonged to them" under lock and key persisted.

Lastly, and in connection with the previous point, the concept of the "traditional technical school" used by the teachers implied a hierarchical distribution of roles, both among them and between them and the students. Hierarchies were also clearly delineated between teachers and students. According to the teachers' accounts, the "traditional technical school" referred to a repetitive and markedly asymmetrical teaching model, in which certain objects prompted actions from both adults and young individuals, participating in the assessment of actions and outcomes. From the students, their ability to solve problems in theoretical disciplinary fields such as electricity, physics, and mechanics was valued, along with their effective execution of various manual tasks that required the manipulation of tools and machines. These tasks contributed to the development of what the teachers referred to as the "technical gesture" —knowledge embodied in actions. As Roberto pointed out, the file was a significant object in this relationship:

> They would give you 25 kids to file. So for the teacher, it was easy to give lessons, they had 22 vise grips, 25 kids filing. And they would watch you. (...) [The teacher] had what's called an "adjustment bench," they would take the piece, pass it through there, and say: "It's done? Keep going, stop." Sometimes, for the ones who were really good, they might intentionally scratch the piece so that they would keep polishing and not have to differentiate.

This questioning of the hierarchical organization of teaching and teaching work also resonated in processes that were taking place contemporaneously at the level of the education system in general. In fact, the Federal Education Law of 1993 constitutes evidence of this process, which aimed to "de-bureaucratize" administrative and pedagogical practices by transforming aspects such as educational centralization and pyramid hierarchies, both in schools and in provincial administrations (Tedesco & Tenti, 2001).

In this section, we examine the process of opening the *black box* of technical education. On one hand, we saw how the group of teachers led by Néstor acted as mediators, taking actions and circulating meanings that locally questioned the "traditional technical school" ("*escuela técnica tradicional"* - ETT), constituted as an effect of the collective action of a socio-material network that regulated ways of conducting and understanding teaching work. This assemblage was made up of a variety of actors, such as the still active study plans of CONET, dominant views on the relationship between school and the world of work, notions about technical schools as a "for a few" modality, the materiality of the workshop (with its compartmentalized sections and specialties) that promoted specific teaching and learning methods, and a variety of objects that guided certain operations—fostering specific dispositions and knowledge. On the other hand, we demonstrated how the process of *de-blackboxing* carried out by ETPA teachers was made possible by the configuration of a new assemblage of human and non-human actors that unfolded both within and beyond the school. Among the human actors, we include, for example, foreign and domestic entrepreneurs promoting the adoption of new technologies in various industry sectors, as well as members of political parties and educational administrators advocating for curriculum and organizational changes in line with technological transformations and demands for modernization of institutional management (Miranda et al. 2006; Tedesco & Tenti, 2001; UNESCO, 1991). Among the non-human actors, we identified new knowledge in different scientific and technical fields, new technological developments, as well as conceptions about: i) the desirable economic-productive and technological development path; ii) the type of

relationships the technical school should have with the productive world; and iii) the transformation of technical schools to become less exclusionary.

The Computer as a Mediator: Actions of Innovation, Emergence, and Expansion of a Socio-Material Network

In this section, we will first describe the gradual, unanticipated, and placement of the configuration of a new assemblage of human and non-human actors in the ETPA through the introduction of the computer into the workshop. Secondly, we trace the innovative effects that this network had on the materiality of the workshop, the work of the educators, teaching methods, and the curriculum selection for the specialty of Electricity.

"There has to be a computer in every workshop"

In one of our interviews, Néstor recalled how, in the late 1990s, a strong debate arose between him and the authorities of ETPA regarding the relevance of having a computer in the workshop. He recounted how this computer, which he referred to as a "very expensive spaceship," was acquired through the involvement of students and educators from his department in a computer science olympiad organized by the Institute of Technical Education[9]. The following excerpt, where Néstor remembers this moment, demonstrates how bringing the computer into the workshop marked the beginning of a series of conflicts and "struggles."

> When the Pentium 100 came along, there was a debate about who would keep the computer. "Hold on, guys," I said, "this computer came here to do a job." But first, the principal took it to his office, and the administrative office used it to process report cards... "You're all mistaken, guys. This computer is for the students, not for you!" I told them. An authority from the school said to me, "But there's no computer in the school that's outside the computer lab." "Yes, this is going to be the first one," I said. "But how can you put a computer in a regular classroom?" they asked. "Well, why not?" I answered, "There should be a computer... in every workshop, a computer in every one!" My first struggle was to argue with everyone so that the computer wouldn't end up in the administrative office... We set up the computer, I placed it in a classroom within the workshop, and everyone came to see it... And with that computer, we won first prize in an inter-school science competition... What was the first prize? Another computer... And there were two computers. Not one, but two computers... They were the first two computers that were outside the confines of the computer lab... It was like a paradigm shift. The computer outside the computer lab.

This quote illustrates not only the gradual formation of an association based on affinities and interests among human and non-human actors, but also the role that Néstor played as a mediator – an actor who carried, shifted, and contested meanings that shaped the workshop space and established modes of teaching. This "struggle" involved most of the authorities and computer science teachers, as well as colleagues from the "old" workshop who, as we saw in the previous section, perceived technological transformations as a threat.

During the 1990s, computers began to enter high schools in Buenos Aires. This occurred as this technology became more widespread and its costs decreased (though the rate of incorporation varied widely depending on the type of institution, the modality, and the management sector). By the end of the same decade, as this quote illustrates, the location within the school where these devices were used was the computer lab. According to Néstor and other teachers, in this space, the computers were "under lock and key" and were not accessible to

[9] This organization was created in 1995 and its objective was to develop policies related to Technical and Vocational Education at the national level.

either students or teachers from the workshop. In their words, "you had to jump hurdles to get a computer."

For Néstor and several colleagues and students at ETPA, "having a computer" became a "necessity" at that time. A trip that Néstor took to Spain in the late 1990s, thanks to a scholarship, allowed him to see how computers were used in teaching electricity and in the work of electric technicians. The following dialogue illustrates this "necessity" and how his actions contributed to the association of human and non-human actors, as well as the destabilization of the knowledge required by a technician and the equipment they needed to incorporate into their daily work.

> **Néstor**: (…) the use of the computer as a working tool. In Spain, they had it much clearer. For us, with computers, it was the opposite (...) We needed computers, we didn't have them, and we needed them because we were saying, "look, (...) this can be designed on the computer." The computer is basically a design tool for the technician.
> **Analía:** When is the computer used as a tool for design at school?
> **Néstor**: (…) In '96-'97 with Windows 3.1... Windows 95 was available, but at the school, Windows 3.1 was used (...) which supported some simulators. (...)
> **Daniel**: Most of the simulators, even with Windows 3.1, ran under DOS. DOS was the disk operating system, which was not graphical at all, it was all text-based. (...)
> **Néstor**: When I first saw the AutoCAD, I said, we cannot *not* use AutoCAD in the school.

This interest in using the computer and specific programming languages by both teachers like Néstor and Roberto and students alike, such as Daniel—who would later become a teacher—was based on their ability to streamline, speed up, and make the task of "designing" more accurate. In Roberto's words:

> Designing is creating plans. Before, when I used to draw... I had the famous drafting table... two meters by one fifty with parallel rulers, lights. I had to make a plan that was 12 meters long, all by hand, I cried! To think that I drew those plans and nowadays I'd rather die. I spent hours of my life drawing plans. I had to draw—I'll never forget it— the San Isidro substation. The power station has 20,000 little switches and I had to draw each and every one. Nowadays, with AutoCAD, you draw one and copy and paste the rest. Besides, it's better, the drawing, the lines.

The two previous quotes refer to AutoCAD, a computer-aided design software that was used in the late 1990s on early desktop computers. This program, which served technicians to carry out the once artisanal and demanding task of drawing plans, was born with a rather "elementary" version (1.0), which was constantly revised to integrate more information, represent it in an increasingly flexible and fast manner, and to be learned quickly and easily by its users. Néstor also mentioned DOS and Windows as operating systems on which AutoCAD ran. All these software programs were created in the United States in the 1980s and arrived in our country during the 1990s.

The integration of the computer into the workshop for "designing" was a process that took time, equipment acquisition (which took years in the case of ETPA and was driven by initiatives of groups of teachers interested in using them), and the appropriation of new knowledge by these teachers (through self-learning strategies and/or training in the industry). This process was part of a broader, albeit slow locally, movement of innovation in fields of knowledge and technological transformations: the gradual spread of computer use—first in

industries and even slower and more limited in schools;[10] the creation of specific commercial software; a strong crisis in the technical school as a modality (which, after the enactment of the Federal Education Law in 1993, resulted in its elimination as such in most jurisdictions of Argentina except CABA); and the growing recognition by teachers and technicians of the relevance of "these technological advancements" for their work (especially for those who worked or had worked in the industry). In ETPA, it's possible to trace the association of these human and non-human actors—with their specific interests and logics—and how they began to question and alter established forms of teaching electricity, defining valuable curriculum content, and understanding what constitutes a good technical teacher.

Innovating the Electrical Speciality at the ETPA "on the sly"

In the mid-2000s, the Department of Electricity at ETPA was losing enrollment in favor of the electronics specialty. The interpretation of the group of teachers who started working together was that electronics was a specialty that only produced "plug and play part replacement" technicians and not "true technicians" (in a national context where the majority of equipment was imported and it was practically impossible to design equipment locally). At that time, seven teachers from the fields of electricity, electronics, and pneumatics, four of whom were interviewed for this study, slowly began to learn to "work as a team," called upon by Néstor. The following dialogue with Roberto illustrates central aspects of the process of association between human and non-human actors that was forming.

> **Roberto**: The students were no longer choosing electricity; most of them were opting for electronics. It was a disaster. They ended up becoming mere parts changers instead of proper technicians. So, Néstor starts to transform what the specialization was. I told you that the specialization had an industrial electronics orientation, and he began incorporating the communication aspect. We were producing mechatronic students without the mechanical component. Because at the school, we couldn't link the mechanical part of the vocational training cycle with us. So the specialization was electric, and we couldn't introduce mechanical subjects.
>
> **Interviewer**: But you all still started working together there, even though theoretically you couldn't.
>
> **Roberto**: No, what did we do? A student who needed to fabricate a precision piece, we would talk to Fabián [another teacher]: "Hey, can I send you so-and-so? Will you teach him how to do that?" "Sure, send him over (...) and I'll teach him." On the sly when it came to the school, through connections, it was the mechanics people (...) They would handle everything the students needed related to mechanics. "Hey, he needs to make a mechanical arm, can you explain how to calculate the axis, the arm, what's needed?" That's what mechatronics is. (...) Néstor starts introducing pneumatics into the electrical workshop. Pneumatics is a specialization of mechanics. He begins adding pneumatics as a control element (...) the famous robotic sensor. Nowadays, most industries have about 90% of pneumatic production. Clean technology, non-polluting, fast (...) the machine that puts the lids on yogurt containers is pneumatic (...) We showed the students that electricity isn't just turning a light on and off. It's about controlling a machine

[10] During the 2000s, various industries in Argentina began to increasingly incorporate the use of computers in the distribution and production of a variety of goods (something that had already been successfully widespread in various sectors of the economy in developed countries since the '90s). Despite this, as stated by Gallart (2006), these processes of "technological innovation" were still not taking place in many technical schools. However, this same author explains that in some schools, there were "innovative" teachers who, either individually or in groups, taught up-to-date content due to their involvement in certain industries.

> that sorts pieces of different shapes and sizes, and the machine decides on its own where to store them. So, of course, the students were amazed. Saying "I turn a light on and off" is one thing, but saying "Wow! I have a robot that stores my pieces" is something else.

In this dialogue, we can trace, first and foremost, the formation of an "us" among the teachers, based on trust and the sharing of enthusiasm, interests, and affinities. This sense of identity was also fostered through their participation in "struggles" with others within the school, as well as beyond it. These disputes were conscious, open, and, as they told us, "resulted in making enemies who later came back to haunt us." According to the teachers, these expressions of conflict sometimes manifested in battles over positions, heated discussions in work meetings, and confrontations over seemingly trivial matters. The "others" (from whom they distanced themselves and differentiated at every turn at that time and during the time of the interviews) were teachers from the specialties of electricity, electronics, and pneumatics, as well as authorities who didn't share this way of understanding the relationship between technological transformations and teaching work.

The quote also illustrates how this association was introducing novel ways of working among teachers, as it involved disregarding established hierarchies in the workshop and acknowledging others, such as Néstor's leadership. The phrase "on the sly" that Roberto used referred to the fact that this type of collaboration between mechanics and electricity teachers was not authorized or well-received by various authorities at ETPA—at that time, the mechatronics specialty was not formally established in the technical schools of the City of Buenos Aires. The teachers explained that this collaborative work was primarily built on relationships of "trust" and personal affinities. By the end of this experience—around 2014—more than half of the teachers in the electricity department had "joined in." This quote highlights the spontaneous, situated, and experimental nature of the new ways of working among teachers, which challenged the historical division between theory and workshop, as well as the organization of rotations for students and teachers. Unlike the pedagogical space of the workshop, this type of activity created interactions between students and teachers from different subjects and at different times, aiming to produce "useful" artifacts that required the mobilization of theoretical and practical knowledge to solve "real problems."

Another innovative effect of the collective action of this socio-material network, which can be traced in this dialogue, is the introduction—also "on the sly" —of new curriculum content that integrated electricity, electronics, and pneumatics, effectively outlining a new electromechanical education. This differed from what formally existed in the technical education modality of the City of Buenos Aires. For these teachers, this meant challenging the compartmentalized teaching approaches that had historically solidified in these specialties and that were upheld in this newly created curriculum. In this process, new ways of teaching with objects were also being shaped, with the dual goal of engaging and interesting students, while teaching in line with specific industrial production logics. In this example, it's evident that for the teachers, demonstrating functioning artifacts and machines to students—such as the robotic arm or the piece-sorting machine—highlighted the "cross-cutting nature of content." This meant that electricity was connected to robotics and mechanics, and that the linkage between these disciplines was a key factor in the automation of various processes involving computers. The introduction of the computer "into the workshop" radically altered how humans interacted with machines and enabled these machines to replace humans in controlling and operating other machinery.

These innovative effects can be particularly traced in the participation of teachers and students in "contests". According to the teachers, these events, along with the "awards" and "achievements" they garnered in these instances, were crucial for the growth of the enrollment in the Department of Electricity, the acquisition of updated equipment, and the recognition of the

school's work by educational agencies, companies, and professional associations. The latter especially valued the work being done in the field of automation. The contests were organized by companies (such as Siemens), professional associations (like AADECA, the Argentine Association of Automatic Control, and AAFCON, its international counterpart), and national educational authorities (such as the National Institute of Technical Education created in 1995 under the Ministry of Education). In the following excerpt, Roberto illustrated the importance of this strategy in obtaining external resources and alliances to sustain these innovations and to promote desirable modes of teaching and teaching work:

> We entered the contests, first and foremost, for the equipment. But also because it was practice for the students. They didn't talk about vocational practice, but working in a contest is vocational practice. Because you work on a project and for that project, you have delivery times, you have forms, there are ways of presenting, cost analysis. It's a real project. This isn't "I'm going to make a trip to the moon and create some random project." You have to show that it works and the project gets done. In fact, Siemens, one of our strongest supporters, if they see the project as viable, they cover all the expenses. So the student can work on such a project outside. What he thought of, what he designed, he can make it happen (...) For a technician, it's like "wow, I created this and I can actually do it!" That's the difference between just replacing parts and actually creating something. What I thought of is feasible. Obviously, this isn't something done overnight; it's a work in progress. (...) We started participating in contests, working together, and it happened, it happened that the students started to come together, and most of them got engaged.

Here Roberto was referring to a "project-based pedagogy"[11] that, on one hand, provided experiences similar to what electrical technicians would encounter in the industry (even serving as pathways to job opportunities and patenting ideas), and on the other hand, strongly contributed to the formation of a collective identity ("us" or "we").

This process of expansion of the socio-material network—although not leading to lasting stabilization—was accompanied by the creation and improvement of the "work environment in which teachers and students participate" (Department of Electricity Blog, May 2011), through the introduction of equipment—installed by the teachers and students themselves—and the establishment of new learning spaces—such as the "laboratories of electrical measurements and electric machine tests," and the "industrial automation workshop-classroom" (2011). These artifacts were obtained not only through competitions and "olympiads," but also through donations from companies and, starting from the mid-2000s, by "winning" state funding within the framework of the Plans for Improvement in Technical Education. This funding accompanied the enactment of the Technical-Professional Education Law in 2005, which aimed, similar to this group of teachers wanting to "revolutionize," to update contents, teaching and learning methods, and to eliminate the separation between theory and practice that still prevailed in technical education.

The effects of the collective action of this socio-material network, which, in Roberto's words, "revolutionized" the teaching of electricity and the teaching profession at ETPA, can be recognized in the materiality presented in the following photo taken by Néstor in 2013. It was taken in the same space that the Photo 1 of this article captured, the one where he mentioned having to "get rid of" almost everything because it was "unusable."

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[11] In traditional secondary education, teaching focused on interdisciplinary projects began to be seen as a desirable horizon starting from the past decade (particularly with the introduction of the "Secundaria del Futuro" program)

Figure 2

Industrial Panel

Source: Photograph taken by Néstor. Year 2013.

This image, as stated by Néstor himself, materially depicts "the final stage of a process of technological innovation and curricular adjustments" analyzed in this section. It visually represents material, curricular, pedagogical, and labor-related innovations produced by this network of human and non-human actors. This extensive socio-material assemblage was composed of technology, software, equipment, regulations, educational policies, companies, professional organizations, foundations, forms of productive organization, ways of understanding the relationship between work and technical school, teachers, students, and authorities interested in participating in "projects" where they could collectively apply technical knowledge to address what they perceived as "real problems."

Conclusion

In this article, we demonstrated how the questioning and innovation of work methods, curriculum, and teaching approaches in a technical school in the City of Buenos Aires were outcomes of the gradual, unforeseen, and slow emergence and expansion—though not lasting stabilization—of an assemblage of human and non-human actors (both within and outside the school, contemporary as well as spanning different temporal folds). We described how this socio-material network locally participated through everyday and seemingly minor actions, engaging in disputes (more or less open and conscious for its human actors) concerning ways of understanding technical labor, education, and work within the school. We examined how this network creatively and locally enacted educational policies, revealing the productivity of Actor-Network Theory in making visible the performative power of objects and artifacts, as well as other non-human actors. Thus, this theoretical and methodological journey contributes to expanding the horizons of educational innovation policy studies in Argentina and other Spanish-speaking countries in Latin America.

Following ANT, we described actions of a network (in which Néstor and the group of teachers participated) that, on one hand, began to denaturalize and question the technical school born with CONET, in a context of strong questioning of the very existence of technical schools at a national level, and on the other hand, to "innovate" the Electric Department of ETPA. These latter actions altered spaces, work methods, teaching approaches, and curriculum contents to the extent of unofficially forging (in the teachers' words, "on the sly") a distinct electromechanical training different from the existing curriculum, promoting content cross-cutting, collaborative work among teachers from different subjects and departments, and the circulation of objects that had hitherto been exclusively used in specific sections.

To achieve this, we first demonstrated how the innovation of the Electric Department of ETPA involved a lengthy process of associations and translations among human and non-human actors within the school, which in turn had connections to other times and spaces, and to actors operating outside of it. To do so, we first delved into the process of questioning the "traditional technical school" through the analysis of the narratives of ETPA teachers. The configuration of a new socio-material assemblage allowed them to defamiliarize themselves from the modes of work and teaching they had been trained in and which, starting from the 1990s, they began to perceive as "traditional" and outdated. This initiated a process of "*deblackboxing*".

Secondly, we identified and characterized various innovative actions that took place at ETPA. By tracing a set of objects deemed "outdated" or "useless" by the teachers, we described how computers were introduced into the school as design tools in the late 1990s and how in the 2000s they began to be used as control instruments for other machines. The formation of this new association of human and non-human actors enabled the transformation of work, pedagogical, and spatial logics, and in doing so, it expressed conflicts with others. Conflicts that could be traced in the strong "fights" and "struggles" between the group of interviewed teachers and certain authorities and colleagues from the workshop and technical subjects.

The analytical description we carried out also allowed us to map a wide variety of human and non-human entities that associated themselves by translating their respective interests into creating practices, meanings, and a logic of action. Among these actors, we can highlight: i) technological transformations that were being incorporated into the international socio-productive world and certain national industries; ii) companies adopting these technologies and their representatives promoting activities, "projects," and "contests" in technical schools; iii) notions about the technical school's need to connect with "advanced" industries; iv) advocates of "modernizing" conceptions of institutional and pedagogical management forms aimed at promoting teamwork and weakening bureaucratic and hierarchical forms of work organization in schools (which began to unfold in the 1990s as part of the state reform); v) perspectives on the desirable type of economic development in a country where deindustrialization initiated in the 1970s had reshaped the productive and social matrix (as well as those who promoted them from various fields); and vi) various educational policies, such as the Technical-Professional Education Law (ETP) (which involved a process of revalorizing ETP as a key element for economic progress), the injection of funds and equipment, and the transformation of national curricular and pedagogical orientations that sought to transform key aspects of secondary education (such as its exclusive nature).

However, according to the Actor-Network Theory (ANT), all associations are precarious and demand significant effort from those who form them (both human and non-human) to sustain and stabilize them. Despite the innovative capacity displayed by the network within the social, pedagogical, and work-related space of the ETPA workshop, its actions were met with resistance, questioning, and effective dismantlement. The internal conflicts within the ETPA, something that was replicated within the technical education framework, took a personal toll on the interviewed teachers and their group. It was resolved with the resignation of their leader (who could no longer stay "to witness how everything was being destroyed"), the loss of an ally among the authorities, and the subsequent departure of the remaining members of the group of

teachers who initiated a "revolution" in the ETPA and saw that continuation in the New Technical School where we met them.

But how can we understand the "destruction" of all that had been achieved? Throughout the analyzed period, as we have seen, different studies have mapped other individual or small-scale initiatives that, like those of Néstor and his colleagues, have attempted to transform technical education during the analyzed decade[12]. As a hypothesis, we will say that the "destruction" of innovations within the technical education framework—during the analyzed period—would reflect the lack of legitimacy and territorial scope of the socio-material network that drove them both within and outside the school.

In the first place, strong struggles and controversies arose among different socio-material assemblages regarding the technical school as a specific modality, as well as about how to understand the relationship between secondary education and the productive world. Some traces of this complex and contentious process included the elimination of technical schools as a modality in most jurisdictions by the Federal Education Law of 1993 (with the City of Buenos Aires being an exception); its subsequent reinstatement at the normative level through the Technical and Vocational Education Laws (2005) and the National Education Law (2006); and the establishment of funding lines starting in 2005 aimed at equipping technical schools nationwide. In other words, technical education was "in crisis" and subject to various criticisms and challenges that received varying degrees of legitimacy and support within and outside this modality. This article unfolded how these disputes unfolded in a situated manner through the analysis of the case of ETPA.

Secondly, the persistence of the socio-material network that upheld the "traditional technical school" (with its "outdated" curriculum, its organization of time and space, teaching methods, and the work of teachers), as well as the insularity of technical schools regarding reforms aimed at altering bureaucratic-hierarchical organizational forms in schools, allowed for the hindrance, censorship, and/or punishment (in more or less formal and explicit ways) of those who promoted innovative actions such as the ones we traced in ETPA.

It will be within our focus for future work to continue examining these disputes surrounding technical education, their renewed associations that will inevitably seek to transform it, and perhaps achieve the long-awaited "revolution."

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[12] An important official initiative (in terms of resources and its interdisciplinary nature) from the Education Department of the Autonomous City of Buenos Aires (CABA) was the Technical School Transformation Program carried out through an agreement with the government of the Basque Country. It was coordinated by Julio Testa, a well-known sociologist, who, along with his research team, educational administration officials, and teachers, developed a plan to change material, labor, and social aspects in line with what was happening at ETPA.

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