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Historical evolution of research scientific training at the University of El Salvador

Evolución histórica de la formación científica investigativa en la Universidad de El Salvador

Evolução histórica da formação em pesquisa científica na Universidad de El Salvador

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Abstract

Research is fundamental in the development of scientific thinking; therefore, the educational process must contribute to the generation of knowledge and alternative solutions to the various problems in society. This article aimed to analyze the historical evolution of research scientific training at the University of El Salvador and reflect on its challenges in the 21st century. The study employed a qualitative methodology that, through historiographical systematization, combined theoretical and empirical methods such as historical-logical analysis, analytical-synthetic methods, literature review, document analysis, scientific observation, and triangulation

of findings. It was identified that the conception of research scientific training was initially assigned by political and economic elites. Later on, it became associated with the production of technical instrumental knowledge and a qualified workforce. It is noteworthy that the University of El Salvador (UES) faces the challenge of promoting and developing the research scientific component within its organizational culture. This is in order to educate competent professionals in all fields of knowledge capable of providing solutions that contribute to the social development of the country.

Keywords: scientific research, university, training processes, internationalization.

Resumen

La investigación es fundamental en la formación del pensamiento científico; por tanto, el proceso formativo debe contribuir a la generación de conocimientos y alternativas de solución a los diversos problemas de la sociedad. El presente artículo persiguió analizar la formación científica investigativa en la Universidad de El Salvador desde una perspectiva histórica; y reflexionar acerca de sus desafíos en el siglo XXI. El estudio empleó una metodología cualitativa que, mediante la sistematización historiográfica, combinó métodos teóricos y empíricos como el histórico-lógico, el analítico-sintético, la revisión bibliográfica, el análisis documental, la observación científica y la triangulación de los hallazgos. Se identificó que, la concepción de la formación científica investigativa fue asignada por las élites políticas y económicas en sus inicios; y posteriormente, se ha ido relacionando con la producción de conocimientos técnicos instrumentales y la fuerza laboral calificada. Se destaca que, la UES enfrenta el reto de promover y desarrollar el componente científico investigativo en su cultura organizacional, a fin de formar profesionales competentes en todas las áreas del saber, capaces de brindar soluciones que contribuyan al desarrollo social del país.

Palabras clave: investigación científica, universidad, procesos formativos, internacionalización.

Resumo

A pesquisa é fundamental na formação do pensamento científico; portanto, o processo de formação deve contribuir para a geração de conhecimento e alternativas de solução para os vários problemas da sociedade. Este artigo buscou analisar a formação científica em pesquisa na Universidad de El Salvador (UES) a partir de uma perspectiva histórica e refletir sobre seus desafios no século XXI. O estudo utilizou uma metodologia qualitativa que, por meio da sistematização historiográfica, combinou métodos teóricos e empíricos como o histórico-lógico, o analítico-sintético, a revisão bibliografia, análise documental, observação científica e triangulação de dados. Identificou-se que a concepção de formação científica investigativa foi atribuída pelas elites políticas e econômicas em seus primórdios; e então se foi relacionando com a produção de conhecimento técnico instrumental e a força da mão de obra qualificada. Ressalta-se que a UES tem como desafio promover e desenvolver o componente científico de pesquisa em sua cultura organizacional, a fim de formar profissionais competentes em todas as áreas do conhecimento, capazes de oferecer soluções que contribuam para o desenvolvimento social do país.

Palavras-chave: pesquisa científica, universidade, processos formativos, internacionalização.

Introduction

The university is a system where professional training, science, innovation, and social outreach processes converge. Its mission within sustainable development obliges it to respond to the constant demands of its environment and society at large. To this end, the integration of these processes is called to be the only expeditious path in the face of the formative, technological, and environmental challenges emerging in the 21st century.

Within this interconnection, scientific research becomes a central, cross-cutting axis for the education and performance of future professionals and university stakeholders themselves. This is in order to generate the ethical and cultural values that effectively drive the desired social transformation outlined in the Agenda 2030. Therefore, the production, application, and communication of new knowledge must be fostered from within the professional training process itself. This should take into account the theoretical and practical development in the various

disciplinary areas within the institution, the empirical knowledge accumulated by its teachers and researchers, and the organizational history and culture, all of which are part of the context in which all university processes occur.

In this regard, research scientific training in higher education solidifies the research culture and critical thinking in the professional performance of both teachers and students. However, in order to develop this, the teacher must embody a scientific culture that allows them to analyze and intervene in the reality that surrounds them, as referred to by Ramos *et al.* (2018). Hence, this is the first challenge that teachers face in the longed-for university of the 21st century (Deroncele, 2020; Vargas-Pinedo *et al.*, 2022).

In addition to the above, the internationalization of higher education requires the establishment of strategic alliances in favor of educational quality and the solution of the most pressing social problems at the global, regional and national levels, especially in the areas of science and innovation. According to Ladino and Salazar (2022), in Latin America and the Caribbean:

> The tactics promoted within the framework of internationalization are diverse and not limited solely to student and faculty mobility. They extend to core functions such as research, social outreach, entrepreneurship, and innovation. These opportunities are represented in academic events, networks, partnerships, double degree programs, academic courses, presentations, collaborative projects, articles, and other processes that are transversally supported by the use of information and communication technologies. (p. 17)

As can be seen, this challenge also implies a renewal of university management to incorporate teaching, research, and social outreach into this increasingly predominant dimension on a global level. It serves as an indicator to assess the growth of Higher Education Institutions (HEIs). Therefore, the dynamics of internationalization as a process must be grounded in the university's own system of activities and core functions, conceived comprehensively, based on relevant outcomes in the field of science and technology.

While analyses have been conducted on the indispensable relationship between these functions and processes, it is necessary to continue their deepening and awareness-raising at the University of El Salvador (UES). It is not enough to make a legitimate declaration about their role as a determining factor in the quality of HEIs and their leading role in social and economic development. A thorough analysis is required to provide an understanding of their current state and chart the path to achieve these goals.

Recognizing the importance of research scientific training and its shortcomings at UES, programs of study have been reformed, and institutional structures with a research function have been improved, thereby enhancing the qualifications of the teaching staff, among other actions. However, there is still a need to redirect the organizational culture and strengthen the research skills of professors to assume and exercise them in the educational process. In other words, it is necessary to conduct research in order to teach how to do it.

In this sense, it is essential to disseminate the true scope of scientific research and not confuse it with completing exercises, participating in intervention projects, or other occasional lines of work. This can lead to incongruent institutional positions by not giving due importance to the formative process for scientific research and through it. It also results in a lack of motivation for a more holistic education that aims at the advancement of science, the pursuit of truth, creativity, and the development of logical, analytical, creative, and systemic thinking, which should necessarily be reflected in all professionals.

Positions vary depending on one's conception of what *research* is and what it means to be a *researcher*, as well as their social objectives. This relates to the understanding and diversification of thought patterns that are synthesized through practice within the context of history. Consequently, it is vital to understand how research scientific training is configured at UES in order to fulfill its social mission as an institution advocating for quality education. It's also crucial to examine how the internationalization of its processes has influenced its conception over time. This helps in projecting its development in both functions, aligning with current demands.

In light of these questions, this work is aimed to analyze research scientific training at the University of El Salvador from a historical perspective and reflect on its challenges in the 21st century.

Materials and Methods

The study followed the historiographical method, which involved exploring and reviewing primary, secondary, and auxiliary sources of information, as well as systematizing the literature, optimizing historical-logical and analytical-synthetic methods. Tracing institutional documents was fundamental to obtain data from the past and present, which were then analyzed to arrive at logical results and provide a well-founded explanation of the relationship between research scientific training and internationalization at UES, both retrospectively and prospectively.

Based on this, the research employed a qualitative methodology that, through historiographical systematization, combined empirical methods such as literature review, document analysis, scientific observation, and triangulation of findings related to the study subject. This was done with the purpose of providing an accurate interpretation of the epistemological landscape of research scientific training and internationalization at UES.

Results and Discussion

Foundation, Scientific Pedagogy, and Early Internationalization (1841-1941)

In the historical development of UES, as indicated by López and García (2022), there are events that marked the research scientific training during the liberal period (1845-1856). Among the significant changes is the introduction of analytical and experimental methods in the teaching and learning process. All of this was influenced by the prevailing philosophical thought of the 19th century: positivist rationalism and scientific pedagogy based on experimentation.

In the year 1858, under the rectorship of Dr. C. Rafael Pino, European professors came as part of internationalization efforts aimed at enhancing the scientific quality of the institution. Despite the efforts made by university authorities, by 1861, it was still considered that UES's scientific

production did not meet expectations, as it "did not produce scientific value for society" (Macal, 1976).

In the early second half of the 19th century, under the rectorship of Dr. Gregorio Arbizu, UES witnessed new developments in scientific research. By the year 1868, notable studies were conducted for the time, including research aimed at combating pests and diseases at Costa del Bálsamo. There were also some significant advances in scientific extension, such as the introduction of the Pennsylvania method for determining areas or surfaces. It's important to emphasize that, by that time, the agro-export economic model was already taking shape, so training in this topographical method would be very useful for this purpose.

Subsequently, during the period from 1871 to 1876, at the beginning of the era known as the “Coffee Republic”, the autonomy of UES was decreed. Shortly thereafter, the university centers of Oriente (1876) and Occidente (1885) were founded. By that time, with the coffee elite firmly established in the state's power, there were modifications in the integral life of El Salvador. Under the positivist trilogy "Order, Peace, and Progress," this era led to the founding of the Faculty of Engineering and a privileged focus on experimental chemistry and physics classes. Practical knowledge in these sciences was considered the true foundation of agricultural and industrial progress in the country (Durán, 1975).

Likewise, during these years, the university played a prominent role in the rise of national journalism. Under the decree of press freedom, the magazine "*La Universidad*" was founded, which achieved great international prestige. This magazine published articles of a philosophical, historical, literary, educational, and political nature, generating opinions and critiques about national and international issues. However, scientific articles and other innovations of positivism predominated.

Some time later, under the government of the Creole elite between 1886 and 1899, there was a setback in the autonomy of UES. The executive branch resumed its role as a regulator and made scientific research mandatory in the Faculty of Pharmacy and Natural Sciences, Medicine, and Law. At the end of the 19th century, the country underwent changes that regulated the civil

liberties regime and initiated a period of military authoritarianism, which hindered the proper development of the university.

In the first half of the 20th century, the region began to experience a significant influence from the United States in terms of economics and politics. This led to the abandonment of the progressivism implemented by President Manuel Enrique Araujo (1911-1913) in El Salvador. UES was limited by significant government interference and the influence of powerful groups in the country. In response, a critical movement influenced by Marxist criteria emerged, which, despite the obstacles, managed to enter the university context to socially foster critical thinking.

In the following years, the country entered a widespread crisis in its social, political, and economic structures, which also affected the educational institution. The university focused its efforts on fighting social injustices. In this regard, some research works emerged, such as Sarbelio Navarrete's "*El Estado Centroamericano*" (1913), based on Marxist dialectical criteria, which became a pioneering study at the Latin American level. This author would later become the rector of UES from 1934 to 1936 (Hernández, 2013).

During this period, UES was the only Higher Education Institution in the country. It was characterized by experiencing a series of ups and downs due to state interference and power struggles between liberals and conservatives. Despite this, one constant is identified: the traditional functions of the university, including the production of high culture, critical thinking, scientific and humanistic knowledge, were attributed to it, along with others necessary for the formation of the elite. It was perceived that access to public higher education was primarily for bourgeois families, those involved in politics, and the economic oligarchy of the time.

The above justifies the trend toward the adoption of the predominant philosophical currents of the time. Furthermore, experimental, analytical, and Pennsylvania scientific methods were included as part of the teaching and learning process, which was reinforced by internationalization processes that contributed to research scientific training.

Golden Era and Crisis (1945-1994)

According to López and García (2022), after World War II, there was a socio-economic transformation that changed the way knowledge was understood and applied. *Society* with a greater impact began to be discussed, universities were given greater importance to drive the country's development and projection, and knowledge-based economies emerged.

In 1950, the autonomy of UES was restored, which led to the signing of international agreements between 1955 and 1960, favored the development of academic and research activities. For example, this period saw the strengthening of laboratories in the Faculty of Medicine and the establishment of the Institute of Economic Research.

Under the leadership of Rector Dr. Fabio Castillo Figueroa (1963-1968), a university reform was initiated. This period was crucial for research scientific training because during these years, there was a high level of scientific production and social recognition of UES. This facilitated the establishment of national and international networks, the creation of institutes and research units responsible for directing academic development and research in various faculties, all of which promoted scientific research and positioned the institution as the best university in Central America. This period was referred to as the *golden era*.

Until 1965, UES was the only higher education institution in the country. In response to the progressive direction that the institution had adopted, private universities emerged as a reaction from conservative sectors. During that time, in the Latin American and Caribbean region, under a focus on social justice, the *popular education movement* emerged, which had a political-educational impact on university students, labor unions, and civil society. This event received strong support from the Catholic Church and individuals involved in leftist political organizations, among other sectors. Concurrently, the Alliance for Progress between Central American countries and the United States flourished as a strategy for promoting development and containing revolutionary movements in Latin America.

Starting in 1972, a period of repression began at UES, with a military intervention that interrupted academic reform and forced many professors and scientists into exile. These events were followed by a civil war (1979-1992) that destroyed the university's assets and constituted crimes against " *lèse culture*" (Valle, 1991). Its consequences weakened the institution's academic and scientific leadership, exacerbated by a lack of budgetary, social, and political support. In 1992, UES was not considered in the peace agreements and did not receive the necessary economic support. This circumstance hindered the restoration of its scientific activities.

In the post-war period, the integration of the substantive functions of teaching, research, and social outreach was developed in an irregular and deficient manner. Of these three, it was probably research that suffered the most. According to Argueta (1993), the crisis in which UES found itself was part of the national crisis of the entire system but with differentiated characteristics:

> A crisis of relevance due to the incongruence between the traditional educational model and the current and future requirements of Salvadoran society in terms of higher education (...), the lack of clarity about the nature of the challenges, as well as the magnitude of these challenges, precisely define the crisis of expectations. (Argueta, 1993, p. 10)

Due to the turbulent context in which the institution carried out its activities during this period, it became incapable of fulfilling its functions of high culture, critical thinking, and the generation of scientific knowledge for the benefit of society. While there was an emphasis on using the dialectical method in teaching, which favored the development of social and human sciences, these events led the government of the time to seek other alternatives through private universities starting in 1965. Thus, when UES ceased to be the only higher education institution producing knowledge, it also entered what is known as a crisis of hegemony (de Sousa, 2007).

Reforms, Complexity, and Competencies (1995-2021)

In the context of the *Peace Agreements* (1995-2005), a new educational reform was implemented, based on a model of education grounded in the values of a culture of peace. The decentralization of public education to the private sector was promoted, fostering educational neoliberalism. The *Law of Higher Education and its General Bylaws* were approved, as well as the establishment of the National Directorate of Higher Education as the governing body for higher education. All of this projected that, for the five-year period from 2004 to 2009, strengthening scientific research would become an institutional priority. During this time, UES was in a state of academic and scientific stagnation. In the late 1990s, a new shift in educational paradigms began to take shape internationally. The *Delors' Report* (1994) contributed to this by establishing the four pillars of education - learning to know, learning to be, learning to do, and learning to live together - which would serve as the foundation for later reflections by Morin (1999) in "*The Seven Complex Lessons in Education for the Future"* on how to educate in a changing society. Both documents favored the adoption of the competency-based model for education, which would ultimately become the most prominent educational approach.

In the year 2000, the Ministry of Education outlined the challenges of educational reform for the new millennium. These challenges were primarily characterized by promoting quality and access to education through the establishment of the necessary structures. In the same year, at the request of the Inter-American Development Bank, UES made a technical proposal for academic and operational transformation, based on constitutional principles, the *Law of Higher Education*, and the new *Organic Law of the University of El Salvador*. One of its central axes aimed to reinforce the importance of research in the cohesion of the university's substantive functions (Tünnermann, 2000). In 2004, the *Tuning* project emerged as an initiative to develop unified and accredited professional profiles that encompassed desirable generic competencies according to the requirements of the globalized world. Its focus was an attempt to unify the universities in the region, much like the universities of the European Union did years earlier. While this contributed to addressing some challenges of higher education in the 21st century, such as accreditation and internationalization, it remains a tool for universities to meet the needs for qualified labor required by economic power groups.

In 2005, under the rectorship of Dr. María Isabel Rodríguez, a study was conducted to diagnose the scientific capacity of UES. It identified the need to establish an organizational structure that would serve as the regulating and promoting body for research at the institutional level (Macaya, 2005).

Shortly after, in 2009, the Deputy Ministry of Science and Technology was established as part of the Ministry of Education. This prompted the opening of the National Health Research Center at UES, and later the creation of the Council for Scientific Research and the Secretariat for Scientific Research, as the body responsible for promoting, coordinating, and implementing the university's scientific and technological development policy. In 2012, the *Minerva* journal was founded as part of the scientific development during this period.

However, according to Escoto (2015), "despite all this institutional structure, an academic, administrative, and normative reform was necessary to facilitate the transition from a teaching university to a new university that balanced its academic functions: education, research, and social outreach" (p. 28). In this regard, in 2014, UES had initiated a reform of its educational and academic model, using competency-based education as a reference, rooted in its philosophical expression, and applying pedagogical principles framed within critical theories and meaningful learning (Glower, 2014).

During the period 2015-2020, the development of scientific research skills at UES was enhanced by a focus on professionalization through the implementation of various educational programs, including diploma courses, specialized courses, master's, and doctoral programs. These programs featured both national and international faculty members with recognized academic and scientific backgrounds. In April 2018, the Interdisciplinary Doctoral Program in Education was established through Agreement No. 011-2017-2019 (V-2.3) of the University Superior Council. It became the country's first doctoral program and highlighted the increasing importance of scientific research training at UES.

This initiative was conceived within the Multidisciplinary Faculty of Occidente, with the participation of professors from the University of Havana and the University of Pedagogical

Sciences Enrique José Varona, as part of cooperation agreements between the Salvadoran institution and these two Cuban universities (UES 2017).

It is important to note that, as a result of this doctoral training process, the journal "*Diálogo Interdisciplinario sobre Educación*" [Interdisciplinary Dialogue on Education] was created in 2019, to publish the scientific results of faculty members and doctoral candidates. This reinforced the efforts aimed at disseminating knowledge, which had already been carried out by other journals at UES, such as *"La Universidad," "Derecho," "Agrociencia," "El Salvador Coyuntura Económica," "Humanidades," "Relaciones Internacionales," "Comunicaciones Científicas y Tecnológicas," "Minerva,"* and *"Conjeturas Sociológicas."*

However, during this same period the UES faced a series of contradictions that generated an institutional crisis. As a result, the process of adopting the new educational model with the standards of quality, efficiency, productivity, relevance and social responsibility that the country requires, has not yet been generalized in all its faculties.

Scientific research training, perspectives and challenges in the 21st century

Currently, the research function at UES has several structures. Among them, the Secretariat of Scientific Research stands out, covering areas of knowledge such as exact sciences, engineering and technology, health sciences, agricultural sciences, social sciences, and humanities. Additionally, the National Health Research Center encompasses seven research areas: health policies and systems, health promotion and prevention, chronic diseases, infectious diseases, genetics, and congenital conditions, environmental health, and food and nutritional security. It's worth noting that there is an ongoing discussion regarding the institutional policy on research and scientific innovation, which has already made significant progress.

While the institution is making efforts to enhance its research function, there is a deficient organization for access to and development of research in existing projects and programs. This deficiency can be attributed to various factors such as the management of funding, limited collaboration with most faculties, the prevalence of experimental designs that restrict inquiry,

reflection, and socio-constructivism of knowledge, and limited engagement with society in the dissemination of scientific results that enable transformation.

The above-mentioned issues affect the institutional dynamics, the scientific research attitude of the professors, and consequently, that of the students. Excessive formalism, schematism, increased teaching workload, the sacred belief in the method, and the lack of creativity among teachers to motivate their students in the search for and discovery of knowledge have a direct impact on the quality of teaching, hinder the development of scientific competencies, and demotivate both professors and students regarding the topic.

Within this scenario, the importance of the role of the educator-researcher becomes evident, which signifies a commitment to change and transformation. The research function must be integrated into different subjects so that students learn to research by conducting research themselves through the implementation of innovative pedagogies that stimulate meaningful learning and creative and proactive thinking.

Therefore, according to Rojas and Aguirre (2015), professors must have the necessary competencies to create variations and alternatives that, in their teaching, motivate research in students based on their concerns and involve them in joint projects. To achieve this, it is essential to strengthen higher education policies related to the topic.

From a practical perspective, García *et al*. (2019) point out that internationally, the quality of universities is measured by parameters such as research, scientific production, the number of doctoral graduates, impacts, and awards received. Therefore, if the aim is for UES to have greater international visibility and recognition, it is essential to invest in scientific research, the process of science, technology, and innovation, and create the conditions for tangible achievements in the medium term.

Following the criteria of García *et al*. (2019), international university cooperation should focus on the training of new doctoral graduates, the internationalization of higher education, and the interaction between the university and society, and vice versa. Along these lines, the introduction

of the Doctorate in Education has contributed to the awakening of research activities among its professors in their daily practices and the improvement of their teaching activities. Aguilar and García (2022) suggest that the excellence of the faculty, the human quality of the doctoral students, institutional support, and the revaluation of scientific research activities have been essential pillars in this process.

Conclusions

The concept of research-based scientific education in Salvadoran higher education is the result of a selective historical construction initially designed by political and economic elites, for their benefit, with the purpose of harnessing instrumental technical knowledge and qualified labor force for the prevailing capitalist development. Paradoxically, research-based education should be an endeavor to enhance human development in the nation. Therefore, the revival of a scientific attitude within the institutional collective requires a transformation of its ideological, social, cultural, economic, and educational structures.

It is clear, then, that the UES faces the challenge of promoting and developing the research-based scientific component within its organizational culture, in order to educate competent professionals in all fields of knowledge, capable of providing solutions that contribute to the social development of the country. The strategies to be implemented for these purposes should be conceived from the integration of substantive processes and in close connection between the university and society.

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Authors' contributions

Conceptualization: J.Y.L.V.; Methodology: J.Y.L.V, M.G.G.; Research: J.Y.L.V.; Data curation: J.Y.L.V, M.G.G.; Formal analysis: J.Y.L.V, M.G.G.; Writing (Original Draft): J.Y.L.V.; Writing (Proofreading and Editing): M.G.G.

Conflict of interest

The authors declare that they have no conflict of interest.

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