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PERSPECTIVE OF HEALTH TECHNOLOGY, AS A TRAINING PROCESS OF MEDICAL EDUCATION

PERSPECTIVA DE TECNOLOGÍA DE LA SALUD, COMO PROCESO FORMATIVO DE LA EDUCACIÓN MÉDICA

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ABSTRACT

Introduction: the perspective of the training process of Health Technology in Medical Education, has been conditioned by the advance of biomedical technologies, put into function of contributing to the solution of the health problems that affect societies. Objective: to propose an approach from the perspective of Health Technology as a formative process of Medical Education for the analysis of its genesis, evolution and present-day. Development: the health technologist, of a specific specialty: is the professional in charge of the study and execution of the biomedical technologies in the fulfillment of the functions; assistance, teaching, research and management, with humanism, responsibility, ethical and bioethical principles in health care levels in Cuba and by assuming international medical collaborations for the promotion, prevention, contribution to diagnosis, technological decision making, treatment, recovery and rehabilitation of the patient, with their insertion in the social context, for the sake of the quality of life, when responding to health problems. Conclusions: the Health Technology training process places health professionals in charge of the fulfillment of basic, specific and / or special technological procedures to determine the critical way of the patient or the health problem.

Keywords: health technology, health technologist, Medical Education



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RESUMEN

Introducción: la perspectiva del proceso formativo de Tecnología de la Salud de la Educación Médica, ha sido condicionada por el avance de las tecnologías biomédicas, puestas en función de contribuir a la solución de los problemas de salud que aquejan a las sociedades. **Objetivo:** proponer un enfoque de la perspectiva de Tecnología de la Salud como proceso formativo de la Educación Médica para el análisis de su génesis, evolución y actualidad. **Desarrollo:** el tecnólogo de la salud, de una especialidad específica: es el profesional encargado del estudio y ejecución de las tecnologías biomédicas en el cumplimiento de las funciones; asistencial, docente, investigativa y gerencial, con humanismo, responsabilidad, principios éticos y bioéticos en los niveles de atención en salud en Cuba y al asumir las colaboraciones médicas internacionales para la promoción, prevención, contribución al diagnóstico, toma de decisión tecnológica, tratamiento, recuperación y rehabilitación del paciente, con su inserción en el contexto social, en aras de la calidad de vida, al dar respuesta a los problemas de salud. **Conclusiones:** el proceso formativo de Tecnología de la Salud, ubica en los servicios de salud al profesional encargado de la ejecución de los procedimientos tecnológicos básicos, específicos y/o especiales, para determinar la ruta crítica del paciente o del problema de salud.

Palabras claves: *tecnología de la salud, tecnólogo de la salud, Educación Médica*

INTRODUCTION

If you compare social progress for centuries, you can identify dissimilar events that have marked the empowerment of man in the context that develops, being able to create and transform the environment, to answer to their needs. In the constant search for progress, according to the political order, the economy, or another social factor, a rhythm is established; in a dialectical relationship, which facilitates, in the activities, man evolves and in turn transforms the environment, while maintaining the positive elements, and incorporating new elements that every day humanize the activity, for the sake of social benefit.

In the recent context, the World Health Organization and the Pan American Health Organization, plan actions to improve one of the most susceptible sectors of any society, where, "medical technology", plays an increasingly important role in the health care for patients and populations. The technological advances of recent years have completely modified the panorama of clinical care and the possibilities of intervention in public health.^{1,2} It is evident then, that despite the theoretical and practical knowledge, that man has to facilitate the achievement of the activity, the use of the media should materialize, which should be selected according to the goal to be achieved; which leads to another analysis: in each activity according to the context, the medium will have specific characteristics.

Similarly, health technology is identified: as the application of theoretical and practical knowledge structured in the form of devices, medicines, vaccines, procedures and systems, developed to solve health problems and improve the quality of life.² Biomedical technology, is raised, is the science that studies technological advances related to health, in order to improve the quality of life of patients and help with advanced technological equipment to the detection of serious diseases.³ Both are equivalent to the expression of technology for care of health.

In particular, a much broader definition of health technology has been implemented, proposed by the Office of Technology Assistance (OTA) of the USA in the seventies, encompassing all the clinical practice and the way it is organized.¹ From the previous approaches the authors deduce, what medical technology are all the means, methods, accessories or materials that are put in function of giving an answer to an individual or collective health problem, and all are organized by the human resource in charge of its application, however, it is assumed that, biomedical technology, is the most comprehensive definition, by including technological advances, in line with the progress that is evident in the health services of primary, secondary and tertiary care in Cuba, through the application of the clinical and epidemiological method, with an inter - multi and trans disciplinary approach.



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All of the above, promotes a reality that is attributed to the universities, imposing the social order to train human resources, capable of deepening the study of the biomedical technologies, effectively, taking into account the benefits obtained with its application at the individual or collective level, aimed at achieving bio psychosocial balance. Surely, based on the risk - benefit relationship for the solution of a specific problem, without violating ethical or bioethical principles. In this sense, according to Miralles, "(...) Medical Education, has not been absent in the analyzes carried out in the world events of Higher Education ..." ⁴ Scenarios in which the development of Medical Education, based on the undergraduate and postgraduate training process of the doctor and the nurse, as a pillar of the multidisciplinary health team, for the strengthening of Primary Health Care with the incorporation of technological advances.

However, according to the reasoning that has been made, it is the purpose of the authors to provide an approach from the perspective of Health Technology as a formative process of Medical Education for the analysis of its genesis, evolution and present-day , since it is the health technologist, of a specific specialty: the professional in charge of the study and execution of the biomedical technologies in the fulfillment of the functions; assistance, teaching, research and management, in social interaction and as a member of the multidisciplinary health team, with humanism, responsibility, ethical and bioethical principles, in health care levels in Cuba and by assuming international medical collaborations for promotion, prevention, contribution to diagnosis, technological decision-making, treatment, recovery and rehabilitation of the patient, with their insertion in the social context, for the sake of quality of life, when responding to health problems.

DEVELOPMENT

The documental analysis of the information located in printed and online literature was done in databases such as Ebsco, PubMed, Redalyc and Scielo with the Google Scholar search engine, obtaining 17,600 results in 0.04 seconds with the keyword, health technology, of the international and national scope, choosing 28 bibliographical references of the last ten years. Through the historical - logical study, carried out by the authors, it was possible to identify that Cuba has a long history, in particular for the formation of doctors, which dates back to 1726. On January 5, 1728 the Royal and Pontifical University of San Geronimo of Havana where the School of Medicine is located ⁵⁻⁷ as an academy that organizes and controls the training of the doctor.

In the year 1842 the added phlebotomies race appeared, as it was the origin of dental education in Cuba. ⁸ In 1899, a school of Nursing was founded, founded by Dr. Raimundo García Menocal in his private clinic, with the help of doctors CL Furbush, Emiliano Núñez de Villavicencio and the American nurse Ms. Mary Agnes O'Donnell. ⁹ Supported in the progression of health services, careers for the training of health professionals, went through several plans of study, with the aim of guaranteeing the improvement of a training process, in line with the scientific-technical advances and the tendencies of the Medical Education of the time.

Supported by the approaches of some researchers, ¹⁰⁻¹⁵ at the time did not identify elements that would allow the authors to assert the existence of the training process of the health technologist, there were only empirical assistants in specialties such as: clinical lab and X-rays, personnel that carries out its validation in 1955, in the National Sanitary School, as an entity of the Carlos J. Finlay Institute. (See annex 1) It is appropriate to refer that the triumph of the Revolution marked a before and after in the health area; the government will promoted programs that led to the achievement of biomedical technologies to respond to the demands of the population and, in addition, to raise the quality of health services.

The conditions outlined above, led to the 30th anniversary of the revolutionary triumph, the emergence, in the field of Medical Education, of the career of Health Technology in 1989, with six exit profiles, (see Annex 2) ; which had as precedent, the training of health technicians with a reduced enrollment and experimentally, as a course option for workers (CFW), aimed at improving the professional fulfillment of mid-level technicians working in the health services of the City of Havana (current province of Havana) and Villa Clara, a reality that placed the health technologist, specialized in a specific science, as a member of the multidisciplinary team.



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The training process lasted five years, with the distinction of a common line, organized by subjects corresponding to the exact, basic and social sciences taught from the first to the third year, from the fourth they were verticalized and assumed the subjects of their specialty for the development of the specific skills that were planned in the Education at Work, the educational sceneries facilitated the pre-professional practice of fifth year, and at the same time the preparation of a thesis of degree, where they had to demonstrate their research abilities in a subject related to its specialty. In spite of being an incipient formation, it facilitated to some workers of the sector, the obtaining of a university title, yearning that in some cases was truncated, by the requirement to do entry test. According to the Statistical Health Yearbook, the first graduation was in 1994, with 45 graduates from the six exit profiles. In 2001, only two were graduates and in the first five years 334 alumni graduated.¹⁶ When analyzing the data, the number of human resources that was formed was insufficient to respond to health services in the 90s. However, there was a jump in the quality of services in health services, with the incorporation of graduates, by acquiring a greater scientific-technical development, it allowed them to obtain the results in reduced time and perform basic, specific and / or special technological procedures, according to the requirements of the patient's illness.

The afore mentioned study plan was valid until 2002, when the creation of the School of Health Technology was proposed, at the suggestion made by Commander Fidel Castro Ruz at the graduation ceremony of the emergent health technicians, Therapy Physics and Rehabilitation, Clinical Lab, Transfusion Medicine and Radiology in the Astral theater, in Havana province. The institution is created in the school year 2002 - 2003, attached to the University of Medical Sciences of Havana, to provide continuity of study; through the implementation of a new pedagogical model, with three training outputs, (basic technician, medium technician and graduate) incorporating the 17 specialties that until now offered in Technical and Professional training, extending the training of health technologists to 21 exit profiles. (See annex 2)

The entry requirements facilitated access, by not requiring entrance tests and as a day course in the first year, obtained the title of Basic Technician, as a transitory degree. The training provided the technician with the basic elements of his profession. With his obtaining he could work in the polyclinics of the Primary Health Care, under the supervision of a tutor, to assume the installation of biomedical technology and to respond to the exodus of technical personnel, it has its origin in the special period. The job placement put the student-worker status, to choose for the second cycle of training, which was mandatory, where he was taught specific skills for the development of professional skills, at the end of the third year, he obtained the title of Middle Technician. If he decided, to finish his studies at the end of the intermediate level and assume his duties as a worker could choose for a job change or continue their studies, to join the fourth year to receive the professional cycle, which assured them the development of professional skills in the fifth year of the career in pre-professional practice. Ensuring the rise of their cognitive level for technological decision-making in the three levels of health care, with the added value of digitizing equipment, through Information and Communication Technologies, which favored quality of services and economic savings.

Thousands of young and not so young people graduated from the training process and had the chance to obtain a university degree. According to the Statistical Yearbook of Health, 16 years, 2009 with 14 889 and 2010 with 14 069 were the ones with the most graduates in the country, joining the services in Cuba and the Bolivarian Republic of Venezuela to assume the High Technology Centers (HTC) and the Integral Diagnostic Centers (IDC), for the implementation of basic, specific and / or special technological procedures: expressed in a system of actions with a logical and graded order between its stages, which must be carried out by the health technologist, in the fulfillment of the assigned functions in the different levels of care in Cuba or in the world, to determine the critical route of the patient or the health problem, favoring the promotion, prevention, diagnosis, treatment, recovery and rehabilitation of different diseases.

Researchers such as Rosell¹⁷ and Travieso,¹⁸ report that "The process of training professionals and especially health technologists in Cuba and the peculiarities of the training curriculum requires a coherent and harmonious design between the general demands of training and the needs imposed by the development of health technology." In this direction, the Ministry of Higher Education, project methodological indications for the



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integration of the careers mentioned above and propose the training of health technologists, with a broad profile in eight careers, starting in 2010 (see Annex 2) to assume inter and multidisciplinary functions, approach that is proposed from the design that shows a main integrating discipline that organizes, plans and controls, Education at Work, as a guiding principle, characteristic that distinguishes Medical Education in Cuba, by ensuring the acquisition of knowledge, education in values and the formation of specific skills, the student interacting in health services, with health problems in the real context where care is provided, with the supervision of a tutor.

The design also has its own curriculum that responds to the territorial context where the student is trained. Possibility that ensures the appropriation of the technological advances of its specialty or the deepening in a specific emerging or re-emerging health problem that affects society; in particular, the optional / elective curriculum is projected to achieve a comprehensive formation that allows the student to analyze the social context where he works, and recognize the importance of his work and how it is beneficial to the quality of the service he provides, which has an individual, collective and social impact. The authors assume that the achievements are obtained by the application of a technological method in health, which is based on the principles and foundations of the specialty, in dialectical correlation with the biomedical technology of the context where the health technologist performs, to contribute to the solution of health problems, through the application of technological health procedures.

The researchers Fleitas, Varcárcel and Porto,¹⁹ based on the systematization carried out and the debates held in the different spaces of socialization, defined Health Technology as "the set of inter and multidisciplinary knowledge and procedures for the application and transfer of scientific knowledge and health practices integrated into processes and services for the diagnosis, promotion, prevention, recovery, rehabilitation and training of the National Public Health System, manifested in professional, care, technological, educational and human behavior that meet well-being expectations and needs physical, psychological and social aspects of the population and meet quality requirements and service vocation. "

González,²⁰ conceives that Health Technology is "the system of inter and multidisciplinary knowledge and procedures for the application and transfer of scientific and practical health knowledge integrated in processes for diagnosis, promotion, prevention, rehabilitation and technological decision making, strategies in the professional and human behavior that satisfy expectations and needs of physical, psychological and social well-being of the population and adjust to quality requirements made obvious through the relationship established between professional (health technologist) - technology - man (patient)."

Columbié,²¹ from a more recent analysis and in relation to the process of Science and Technological Innovation, states that "Health Technology is a branch of the Sciences of Medical Education that contributes in a decisive way to the solution of the health-disease problem of Medical Sciences and Health, from a set of knowledge and technological health procedures, for the application and transfer of scientific and practical knowledge, integrated in processes and services that link this professional with biomedical technologies and the patient, adjusted to quality requirements that guarantee safe care, with an epidemiological-clinical-social and ecological approach. "

Related to the systematized approaches, the authors reflect that in the training process of Health Technology, a system of relationships (means, methods, accessories, techniques or procedures) is established, which allows the multidisciplinary teams to be favored, decision making, through the analysis of the results obtained by the implementation of technological health procedures (basic, specific and / or special) based on the fundamentals and scientific principles that understand how the health technologist contributes to the solution of health problems. This is achieved through the fulfillment of its basic functions (assistance, teaching, research and management) in the different levels of health care in Cuba and the world, with the management of biomedical technologies, for the promotion, prevention, diagnosis, taking of decisions, treatment, recovery and rehabilitation, with responsibility, solidarity, humanism, communication, scientific, ethics and bioethics from an inter, multi and transdisciplinary approach, for the benefit of the patient and family as an active social agent.

Specifically, each health technologist applies technological health procedures (basic, specific and / or special) in a logical, ranked order, which establishes stages, and in each of them performs actions that ensure the quality of



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service in Health. In the field of Medical Imaging and Radiophysics, they carry out the process of training and obtaining medical images with sealed and unsealed sources and advanced biomedical technologies, for imaging and morphofunctional diagnosis of diseases of the human body, as well as the application of treatment with sealed and unsealed sources to patients with oncological diseases, with the application of the rules of Safety and Radiological Protection in the context. Clinical Bioanalysis,²² ensures the results of biological samples, for the prevention, diagnosis, control and treatment of diseases; by demonstrating the physiological and morphological alterations that they present, both in the macroscopic and microscopic aspects, by conventional and advanced methods.

Hygiene and Epidemiology,²³ identifies, evaluates and contributes to solving hygienic -epidemiological problems that affect environmental health, when applying the epidemiological method, for the analysis of the health situation. Logophonoaudiology,²⁴ carries out actions of promotion, prevention, detection, treatment and rehabilitation of the alterations of oral communication and hearing. Nutrition,²⁵ implements actions of promotion, prevention and recovery in health related to the food and nutritional problems of the population. Optometry and Optics,²⁶ establishes the prevention, detection, evaluation and treatment of alterations of the visual function, through the fulfillment of visual and ocular exams and also design, verify and adapt optical compensators.

Rehabilitation in Health,²⁷ performs actions aimed at maintaining the state of health of the population, in the bio psychosocial and environmental sphere, through promotion, prevention and rehabilitation, as well as environmental protection, which allows the full incorporation of the individual into their environment. Health Information Systems,²⁸ is responsible for directing and managing processes of recruitment, treatment, analysis, dissemination and exchange of information on health, technological infrastructures and increasingly virtual and collaborative environments, from the registration and study of the sanitary event, to the publication and dissemination of the results achieved in carrying out the processes; with the use of scientific and technological methods, within the framework of the social approach promoted by the Cuban Health System and bearer of the ethical, humanistic and solidarity values that characterize the personnel of the sector in Cuba.

From an cohesive and contextualized vision, the eight careers, contribute with their results to the taking of diagnostic decisions, by providing elements that allow to assert or discard a presumptive diagnosis or to follow up the evolution of the patient in a determined time. At present, the facilities provided by the computerization of health services are expressed, for example, in the Galen Clinic - Softel systems, the SIS - Galen Plus, the Galen Lab, among others for the export and import of results and images to the consultations; which speeds up the flow of information in the institutions, by having a repository which can be accessed asynchronously if it is necessary to redo the analysis of patient data, as well as acquire files with previous results.

To the authors' consideration, actions must be planned to assure the students the acquisition of knowledge and the development of generic and specific professional skills, to assume the advance of the biomedical technologies, seeing the formative process of the health technologist, sustained in the relationships established between (training process - health technologist - biomedical technologies - contribution to the solution of individual or collective health problems - individual, collective and social impact.

Reflecting that in the Education at Work, should verify the development of the professional abilities in an ascending way, according to the objectives of each academic year based on the assistance function, when performing the technological procedures of health (basic, specific and special), with an integrating approach that promotes the relationship with the teaching function, when teaching at their level, with scientificity, respect for the students of the career and responsibility based on the precepts of medical ethics, through the development of pedagogical skills for the training of human resources in their area of fulfillment.

The research function is cohesive, by applying the scientific method to contribute to the solution of the health problems that are presented to it for the improvement of the processes in which it participates. The administrative function, by assuming technical leadership in the service and performing actions to administer human, material

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and financial resources, according to the policies and regulations of the State in the instance that perform under normal and contingency conditions, manifesting with a high level of solidarity, humanism and rationality.

The authors understand that the care function is the rector and integrator of the other functions. By its fulfillment, the health technologist must integrate the career-specific professional skills, teach at his level, while performing in his work, with ethics and respect for the modesty of patients and thus transmit values to students, in addition to knowledge of their profession. As a whole, when fulfilling the assistance function to contribute to the solution of the health problem, it can apply validated scientific methods in other researches and contextualize them in its service or develop research projects that develop the prioritized health programs, thus fulfilling the research function.

In particular, to assume the administrative function, it must have a correct command of the previous functions, with an integrated approach to achieve not only being a link within the health service, when it is responsible for organizing human resources, accessories and materials, but that is capable of being the head of a scientific project, that controls compliance with the established programs, by demonstrating the updating of the topic and that socializes through scientific sessions the technological advances for the application of technological health procedures at their level.

CONCLUSIONS

The perspective of the training process of Health Technology is based on the foundations and principles of Medical Education and Medical Sciences and Health, as a basis to provide the health technologist with the necessary tools to facilitate the achievement of individual satisfaction, as a member of a collective work in the health service, by contributing of the solution of individual and collective health problems, the formation of values, love of the homeland, aptitudes and attitudes, in the fulfillment of its functions, with the appropriate language, to transmit confidence to patients and family members, as being socially useful .

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ANNEXES

Annex 1. Background of the Health Technology career

Dates	Background
January 16, 1927	By means of Presidential Order 1521, the Finlay Institute is created, and established the "National Sanitary School"
In the decade of the 50	In the hospital "The Animas" present Pediatric of Center Havana, begin to give specialization courses with three months duration, for lab technicians, X-rays, parasitology and administrators of hospitals.
1954	It is authorized for the first time the validation of 916 empirical personnel of clinical lab.
1955	387 Empiric X-ray personnel were validated.
1955	For the first time in Cuba, began in 1957 the training of a clinical lab technician, graduated 25.
1958	Graduation of four, auxiliary technicians of clinical lab and 14 auxiliary technicians of X-rays.
In the decade of the 50	-There was no development of the pharmaceutical industry - The optics service was concentrated in Havana City, two small armor factories in Placetas and in Santiago de Cuba - The technical orthopedics showed a poor development the workshops were concentrated in Havana City and three units in Santa Clara, Camagüey and Santiago de Cuba.
1959	Course of two years of lab technician, with 32 enrolled.
1960	- Course of two years of lab technician, with 28 enrolled. - Course of six months of technical lab assistant, with 116 enrolled. - Two-month training course for X-ray technicians, with 141 enrolled. - One-year course of X-ray technical assistant, with 97 enrolled.
Since 1970	New technical courses with three years of experience are emerging. Medical Librarianship, Cytogenetic, Blood and Transfusion Bank, Speech Therapy and Phoniatics, Health Chemistry, Dental Prostheses, Ergotherapy, Social Work and Psychometrics.
1976-1978	Creation of the Polytechnics of Health (PH)

Source: taken from: Ruiz Hernández JR. Cuba, social revolution and public health (1959 - 1984). Editorial Medical Sciences. Havana. Cuba; 2009. Pgs. 13, 33



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Annex 2. Transformations of the training process of the Health Technology career

1989 - 2001	2002 - 2009	2010 - present-day
1. Optics and Optometry	Optics and Optometry	1. Optics and Optometry
2. Hygiene and Epidemiology	2. Hygiene and Epidemiology	2. Hygiene and Epidemiology
3. Imaging	3. Imaging	3. Imaging and Medical Radiophysics
	4. Medical Radiophysics	
4. Laboratory and Blood Bank	5. Clínica Lab	4. Clínica Bioanalysis
	6. Cytohistopathology	
5. Cytohistopathology	7. Microbiology	
	8. Transfusional Medicine	
6. Physical Therapy and Rehabilitation	9. Physical Therapy and Rehabilitation	5. Rehabilitation in Health
	10. Podiatry	
	11. Social and Occupational Rehabilitation	
	12. Ortoprosthesis	
	13. Information Management in Health	6. Health Information Systems
	14. Logophonoaudiology	7. Logophonoaudiology
	15. Nutrition and Dietetics	8. Nutrition
	16. Dental Prosthesis	
	17. Pharmaceutical Services	
	18. Dental Care	
	19. Health Administration and Economics	
	20. Electromedicine	
	21. Traumatology	

Source: prepared by the authors

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Carta de declaración del autor o de los autores

La Habana, 7 de febrero de 2019


Dirigido a: Editora Ejecutiva de la RCTS

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Contribuciones sustanciales para la concepción o el diseño del trabajo.	Verónica Ramos Suárez, ¹
Adquisición, análisis o interpretación de datos.	Suleyka Cabello Daza, ² Valodia Escalona Rojas, ³ Estrella del Coral Williams Abelle, ⁴ Yanay González Aquino, ⁵ Jorge Ortiz Roque ⁶
Creación de nuevo software utilizado en el trabajo.	
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