

The role of technological professional education for the labor market – Pulp and paper technician

Lucas Alves de Jesus¹, Júlio César Neves dos Santos².

ABSTRACT

Professional and technological education (EPT) is provided for in the Law of Guidelines and Bases of National Education (LDB - LAW No. 9,394 of 1996) as an educational modality that has the main objective of preparing for professional practice. In this way, it aims to contribute to the insertion and performance of citizens not only in the world of work, but also in life in society, including qualification courses, technical and technological qualification, and postgraduate courses, which have an organization that seeks to provide the continuous and articulated use of studies (BRASIL, c2018).

Keywords: Vocational education, Labor market, Cellulose.

INTRODUCTION

Professional and technological education (EPT) is provided for in the Law of Guidelines and Bases of National Education (LDB - LAW No. 9,394 of 1996) as an educational modality that has the main objective of preparing for professional practice. In this way, it aims to contribute to the insertion and performance of citizens not only in the world of work, but also in life in society, including qualification courses, technical and technological qualification, and postgraduate courses, which have an organization that seeks to provide the continuous and articulated use of studies (BRASIL, c2018).

In view of the importance of technical training to serve a certain market niche in a locality, we can cite as an example the demand for trained professionals to serve the pulp sector in the Triângulo Mineiro with the creation of the LD Celulose industry. To contextualize, the history of pulp and paper production, the "paper" etymologically derives from "papyrus", according to Martins 1996, these papyrus sheets were already used in ancient Egypt to make writings and drawings, paper as we know it today appeared around 105 A.D. 2nd century in China, and historians attribute the invention to the Chinese Ts'aiLun, however, it was only in 1838 that the chemical formula (C₆H₁₀O₅) of cellulose was discovered by the French chemist Anselme Payen, thus being able to be improved. According to the Brazilian Tree Industry (Ibá), Brazil is among the largest producers of cellulosic pulp in the world, and two are the main sources of wood used for the production of pulp from eucalyptus and pine trees, responsible for more than 98% of production. In the context of pulp from eucalyptus, the country occupies the first place as a world

¹ Student, Federal Institute of the Triângulo Mineiro – IFTM – Uberaba MG

² Professor, Federal Institute of the Triângulo Mineiro – IFTM – Uberlândia MG



producer, this production is favored by Brazil's climatic conditions and by its highly developed forestry engineering.

LD Celulose S.A. is a joint venture between Austria's Lenzing and Brazil's Dexco, founded on February 6, 2018 and is one of the largest dissolving pulp mills in the world. Located in the Triângulo Mineiro, it is located between the municipalities of Indianópolis and Araguari. It has a production capacity of 500 thousand tons of dissolving pulp per year, in addition to 144 MW of clean energy. The special cellulose fibers produced at LD are used in the textile industry, generating fabrics with innovation, sustainability and high technology. The demand for professionals in the pulp area began together with the mill in 2019, for the training of professionals in the region, a partnership was made with SENAI for post-technical training courses, with the objective of training technicians from the various industrial areas. The post-technical courses have a duration of 300 hours and provide a specialization in pulp, so far 83 professionals have been hired who have taken these improvement courses, currently the company has 112 positions in its staff that need this training, but the number of hires depends on turnover (turnover rate of employees of a company).

In order to understand the expressive demand for LD Celulose S.A., it was necessary to partner with SENAI to offer courses. SENAI is one of the largest centers for the generation and dissemination of knowledge applied to the development of industry in Brazil and Minas Gerais. Created in 1942 on the initiative of the sector's business community, SENAI is part of the National Confederation of Industry (CNI) and the Federation of Industries of the State of Minas Gerais (FIEMG). SENAI, through the development of its programs, projects and activities, offers adequate services to the different needs of the industry and contributes to its strengthening and the full and sustainable development of the country.

To meet this demand, SENAI Minas obtained, through SENAI Resolution CR_DR/MG No. 973_22, the authorization to teach the Technical Course in Pulp and Paper at the Araguari MG unit. SENAI already has a great knowledge of professionalization in the pulp area in its education network, and since the demand for professionals in the area is growing in our region, it will start the first class of the technical course in pulp and paper at the beginning of the first semester of 2024.

In this sense, the objective of this study was to evaluate the relationship between the pulp market in the Triângulo Mineiro region and the supply of training, as well as the relations between the demand and supply of professionals, and how the training of professionals is with emphasis on the use of digital technologies for the training of these professionals. In this study proposal we start from the role of professional and technological education (EPT) in the relationship between companies and schools, being interconnected, the training of a technical professional begins at school, through studies of methodologies, science, practices, teaching and learning technologies.



OBJECTIVE

To analyze the possibilities and contributions of the use of digital educational technologies for the development of technical skills in EFA, to demonstrate the importance of these educational technologies for the labor market.

METHODOLOGY

To contextualize professional education, it is important to briefly recall the history of professional education in Brazil, at the beginning of the twentieth century, workers were taught to work in the various productive sectors and in 1940 Nilo Peçanha created the schools of apprentices and craftsmen, being the beginning of a public network of professional education, to be able to disseminate these schools partnerships were made between the state, Thus the National Service for Rural Apprenticeship (SENAR), the National Service for Industrial Apprenticeship – SENAI (1942), and the National Service for Commercial Apprenticeship – SENAC (1946) were born.

The following years were marked by events that had a direct impact on EFA, including the enactment of Law No. 4,024/1961, the first Law of Guidelines and Bases of National Education (LDB) (BRASIL, 1961). Another important historical fact was the institution of the Military Regime, in the period from 1964 to 1985. LDB/1961 brought significant changes to EFA, recognizing the complete integration of vocational education into the regular education system. In 1978, the Federal Technical Schools of Paraná, Rio de Janeiro, and Minas Gerais were transformed into Federal Centers for Technological Education (Cefet) (COSTA, 2022). In 1994, the National System of Technological Education was instituted, which transformed the Federal Technical Schools and the Federal Agrotechnical Schools into Cefet. Law No. 9,394/1996, currently LDB (BRASIL, 1996) allowed a greater concentration on the provision of professional education in the federal education system and provides that EFA covers initial and continuing education courses or professional qualification, technical professional education at the secondary level and technological professional education at undergraduate and graduate levels. With the creation of the Federal Institutes, considered a historical milestone in Brazilian education, there is a rupture of a logic that lasted for years in Brazil. The proposal of an elitist and exclusionary model, characterized by the division between theoretical foundations and practice in training processes, gave way to a proposal that sought to redeem a debt to society (COSTA, 2022).

The use of technology is important for all existing sectors and for education it is no different, this resource enhances the teaching and learning process of students, with the new teaching tools and communication tools the teacher and the student have a range of information, making the educational process more dynamic, efficient and innovative.



According to Silveira and Cogo (2017), digital educational technologies contribute to the diversification and flexibility of activities, enabling students to access content in different places and at any time, going beyond the physical space of the classroom and school. The authors highlight videos, games and hypertexts, software with educational objectives and tools used as digital educational technologies (SILVEIRA; COGO, 2017). In this way, TED expands educational possibilities, not only in the modalities of Distance Education, but also in face-to-face teaching, since they can provide opportunities for broader times and spaces for interaction and learning (HERNANDES; CLAY PIT; DA SILVA GOMES, 2020).

Considering the proposed objectives, a bibliographic and documentary review was carried out, as well as a visit to SENAI in Araguari in order to answer the following question: "What are the main digital educational technologies used in professional and technological education for the pulp and paper technical course?".

The searches were carried out between October and November 2023 by the Google Scholar search tool using the descriptors "digital technologies", "Cellulose" and "professional and technological education".

From the research carried out, 8 complete publications were found with the proposed theme. However, after a thorough reading of the materials, the study consisted of 3 publications.

For data collection in the field, a visit was made to SENAI-Araguari, where the entire structure of the classroom and laboratories necessary to offer the pulp and paper course was presented, in this visit was interviewed the Technical Supervisor Alexandre Oliveira who is graduated in the area of pulp and paper and is a reference in the area, Having several years of experience, he was transferred from Senai in São Paulo to Senai in Araguari for his expertise, 52 questions were asked about the pulp and paper technical course and digital educational technologies.

DEVELOPMENT

The relationship between the labor market and the education and professionalization sector is present in the region of the triangle of Minas Gerais, it can be seen that when the demand for professionals related to pulp production arose, the educational institution opened the doors to professionalize professionals in the region who already had some technical qualification and this partnership tends to grow now with this new opportunity for technical qualification in pulp and paper that will be offered to the public of Araguari from 2024.

The technical courses of Pulp and Paper are offered in the states of Santa Catarina, Paraná, Mato Grosso do Sul, Minas Gerais, Santa Catarina and Bahia and are mostly offered by the Senai system, the



largest job offer is currently in Paraná, Mato Grosso do Sul, São Paulo and Bahia and about 80% of the students who take the post-secondary technical course already work in the area of pulp and paper.

The National Catalog of Technical Courses (CNCT), approved by the National Council of Education (CNE), through CNE/CEB #Resolução No. 2, of December 15, 2020, regulates the offer of technical professional education courses at the secondary level to guide and inform educational institutions, students, companies and society in general. Its content is periodically updated by the Ministry of Education to contemplate new socio-educational demands

According to the data collected in the National Catalog of Technical Courses (CNCT), the profile of the professional after completion of the technical course in pulp and paper will be qualified to: Control processes of obtaining pulp and manufacture of paper, perform chemical, physical and physicochemical tests and analysis of raw materials and products following technical standards and procedures, Plan, execute and supervise the drying and cutting processes in paper production. To work as a pulp and paper technician, it is essential to have knowledge related to the planning and operation processes of the area's assignments, in order to ensure the health and safety of workers and future users and operators of companies in pulp and paper manufacturing processes.

The technical course in Pulp and Paper is classified in the industrial production axis, has a minimum workload of 1200 hours, the technician will be qualified to control processes of obtaining pulp and paper manufacturing, perform chemical, physical and physicochemical tests and analyses of raw materials and products following technical standards and procedures, plan, execute and supervise the drying and cutting processes in paper production, The professional, after graduating, masters the knowledge related to the planning and operation processes of the area's assignments, in order to ensure the health and safety of workers, the sustainability of the production process, standards and technical reports, the legislation of the area, new technologies related to industry 4.0, team leadership, to the solution of technical problems and the management of conflicts, contents and relevant processes of scientific, technological, social and cultural knowledge, has the role of following the changes in technologies and manufacturing processes, needs to know the chemical and physical processes of pulp and paper production, being able to act throughout the industrial plant and even in different sectors, from the receipt of the raw material in the wooden yard to the baling of the finished material. The infrastructure of the educational institution is a fundamental point for learning, it is necessary to have a library with a specific and updated physical or virtual collection, a computer lab with specific programs, a laboratory for physical-chemical tests on paper, a chemistry laboratory.

To offer the technical course of Pulp and Paper at SENAI Araguari-MG, it was necessary to adapt the facilities, acquire equipment and technological resources to offer the course with the desired quality, for the laboratories the following state-of-the-art items were acquired: Autoclave - Rotary digesters of 20



L capacity, equipped with 4 individual reactors, Precision scale, Analytical Balance, Oxygen Cylinder, Chip Sorter, Fiber Sorter, Conductivity Meter (Benchtop), Conductivity Meter (Portable), Cellulose Scrubbers (Coarse and Fine Scrub) Consistency $1% < x < 5%$ Somerville, Cellulose Disintegrator, Digital UV/VIS Spectrophotometer with pre-programmed curves, Microprocessed Sterilization and Drying Oven capacity between 170 and 250 Liters with forced air circulation, Sheet Former, Sheet Press, Sheet Dryer, Microprocessor Muffle Furnace, Hygrometer, Cellulosic Pulp Homogenizer (Mass), Ozone Homogenizer, Ozone Generator, Digital Microscope 16MP 1080P HDMI USB and WIFI with 200x Camera, Trinocular Biological Microscope with 1600x Camera, pH-meter (benchtop), pH-meter (portable), Willey mill, Rota-vapor (evaporation), Physicochemical treatment simulator (jar test), Viscomat Viscomat, Ostwald Viscometer No. 100 with Calibration, Ostwald Viscometer No. 200 with Calibration, Ostwald Viscometer No. 300 with Calibration, Pentosan Content Determination Battery (ABNT 6869 description in the standard), Oil-free vacuum pump for laboratory, Gas chromatograph (Replaced by Inductively Coupled Plasma Spectrometer, High Torque Mechanical Stirrer, Total Organic Carbon (TOC) Analyzer, Near Red Infrared Spectrophotometer – Foss, Biochemical Oxygen Demand (BOD) Meters (Conventional and Metric Vent Methods), 15-Tube COD Reactor, Dissolved Oxygen Meters, Portable Tubidimeter, Benchtop Tubidimeter, Cellulose Centrifuge

The digital teaching technology provides the student with a greater reality of learning, currently in the Senai units in addition to the laboratories that have equipment identical to those used in large companies, the technology allows the interaction of the student with the reality of work through 2D and 3D simulators, robotics rooms, learning systems integration, and augmented reality, CNC, panel-controlled robotic simulators similar to those that exist in the industry.

It is of paramount importance that the student is able to assimilate knowledge through digital tools, because, throughout their career, it will be crucial to have communication, learning, and distance learning skills. In a globalized world, in which interconnection is constant, the ability to learn and share knowledge remotely becomes an essential factor for student success. In this context, the course offered establishes the obligation for 20% of the workload to be taught through distance education (EAD), using platforms such as Google Classroom and Moodle. This approach aims to prepare the student comprehensively, adapting to the demands of the modern professional environment.

The job market expects the professional to demonstrate a proactive posture and innovative attitude, adapting, with creativity and flexibility, to new technological and organizational contexts, to present ethical behavior in professional conduct, living values, respecting principles, practicing inclusion and social justice, respecting differences, Work as a team, sharing knowledge, ideas, experiences and opinions, maintaining a good relationship with the team and also have a good relationship with the team and also have The technical skills of control of pulp production processes considering technical, quality, health,



safety and environmental procedures and standards, master the chemical, physical and physicochemical analysis procedures of raw materials and products.

The partnership between LD Celulose and SENAI has already provided 460 vacancies for courses aimed at the cities surrounding the mill, in different areas of construction and assembly, in addition to pulp operation and industrial maintenance, a partnership that assists in the acquisition of some equipment, a scholarship to help students, technical visits to the mill, For the Pulp and Paper Technical Course, the details of the partnership have not yet been disclosed.

FINAL THOUGHTS

This research aimed to understand the need for synchrony between the labor market and educational institutions, with the advancement of technology it is extremely important for the academic environment to evolve together with companies to teach techniques in order to serve the student public and the labor market.

It can be understood that education is always evolving and currently moves at an accelerated pace due to the great access to information and the ease of interaction between people from different locations, interactions through digital platforms are necessary and bring with them great advances in learning and can shorten the distances between professionals in the pulp sector, researchers and students.

In this context, the technical course of Pulp and Paper is a great investment that Senai MG is making for the development of education in the city of Araguari, the partnership with the private sector is of paramount importance and currently the largest dissolving pulp mill in the country is located in the region, this integration will bring great fruits to the region of the Triângulo Mineiro.



REFERENCES

- Ciavatta, M., & Ramos, M. (2005). A política de educação profissional no governo Lula: um percurso histórico controvertido. *Educação & Sociedade*, 26(92), 1087–1113.
- Moro, D. A. G. (2012). Do trabalho para a escola: olhares de trabalhadores-estudantes e professores sobre as relações entre o saber da prática e o saber da escola (Master's thesis). Universidade Tecnológica do Paraná, Programa de Pós-Graduação em Tecnologia, Curitiba. Available at: <https://repositorio.ifgoiano.edu.br/handle/prefix/656>. Accessed on November 14, 2023.
- Brasil. (1985). Decreto nº 90.922, de 6 de fevereiro de 1985. Regulamenta a Lei nº 5.524, de 05 de novembro de 1968, que dispõe sobre o exercício da profissão de técnico industrial e técnico agrícola de nível médio ou de 2º grau. *Diário Oficial da União*, seção 1, 7 February 1985, p. 2194.
- Brasil, Conselho Federal dos Técnicos Industriais. (2019). Resolução CFT nº 85, de 28 de outubro de 2019. Aprova a tabela de títulos de profissionais dos Técnicos Industriais no SINCETI.
- Ministério da Educação (MEC). (n.d.). Catálogo Nacional dos Cursos Técnicos e Catálogo Nacional dos Cursos Superiores em Tecnologia. Available at: <http://cnct.mec.gov.br/>. Accessed on October 25, 2023.
- Frigotto, G. (2006). Fundamentos científicos e técnicos da relação trabalho e educação no Brasil de hoje. In J. C. F. Lima & L. M. W. Neves (Eds.), *Fundamentos da educação escolar do Brasil contemporâneo* [online] (pp. 241–288). Editora FIOCRUZ. ISBN: 978-85-7541-612-9.
- Silva, J. R. C. (2019). Objeto de aprendizagem para o ensino de HTML: uma perspectiva de aprendizagem colaborativa e avaliação formativa (Master's thesis, Programa de Pós-Graduação em Educação Profissional e Tecnológica (ProfEPT), Instituto Federal Goiano, Morrinhos). Available at: <https://repositorio.ifgoiano.edu.br/handle/prefix/656>. Accessed on November 14, 2023.