

# CHALLENGES OF HIGH SCHOOL TECHNICAL VOCATIONAL EDUCATION

José Fernandes de Lima\*  
Francisco Aparecido Cordão\*\*



\* Doctor of Physics. Teacher Emeritus of the Federal University of Sergipe. Aracaju, Sergipe, Brazil.  
*E-mail:* fernandeslima44@hotmail.com

\*\* Vocational Education Specialist. Owner of the Chair 28 in the São Paulo Academy of Education. Peabiru Educational. São Paulo, São Paulo Brazil.  
*E-mail:* facordao@uol.com.br

Received for publication on:  
2016.8.1  
Approved for publication on:  
2017.3.3

## Abstract

In this paper, we discuss the importance of training personnel for the economic and social development of the country, as well, analyze the availability of work personnel staff and innovation, compare the organization of Brazilian high school level professional technical education with the other countries and identify some challenges that must be faced on the path to offer quality vocational education, that can promote innovation and sustainability for the national economy.

**Keywords:** Education for work. Vocational education. High school.

## 1. Introduction

The central economies adopt a pattern of industrial growth and services that favors the state-of-the-art technology intensive sectors. The cycle of the products become smaller and smaller and decreases the time spent between the development and commercialization phase. Survival in this environment requires an investment diversification strategy and a strong investment in training and professional qualification. The development model characterized by strong scientific content and expertise sets increasingly close links between scientific capacity, technological development and economic growth. As a result, countries willing to adopt such model must combine science and technology with economic and industrial policies and a project focused on the professionalization of individuals.

The technological innovations promoted by developed countries tend to accentuate inequalities and technological dependence and, in some cases, cause political instability in developing countries. Growth indicators show that, currently, innovation contributes more than half of the developed countries' gross domestic product.

This means that innovation is one of the decisive factors for the economic and social development of a nation. For Brazil, the challenge of technological innovation is fundamental to define its effective inclusion in an international developmental scenario.

In this case, the concept of innovation is acknowledged in a broad sense, which includes not only large leaps, but also, incremental changes, new purposes, improved management, new business models and new markets.

Among the main ingredients for creating an innovative environment, there is the need for a research and development agenda and the definition of a policy objectively meant for training personnel able to meet the new demands of the working world. Without investment in staff training, it is difficult to stimulate innovation in companies and make them more competitive.

To create an environment of innovation, the country needs to invest in education, especially in science education at all levels, from preschool to graduate school. It is necessary to increase the population's average number of years in terms of formal education and to increase the scientific literacy indicator.

To maintain a competitive industrial and services park, the country needs to invest in training qualified engineers and technicians with the ability to incorporate new technologies and understand the new processes developed, being able to generate brand new technologies. The provision of training to the personnel to meet these new challenges has been a constant concern, particularly in developed countries. In Brazil, professionalization became one of the foundation stones of the Constitution, which, according to its Art. 227, is a "duty of the family, the society and the State", and must be assured "with absolute priority" (BRAZIL, 1988).

The concern for High School Professional Education has mobilized efforts among managers and educators from around the world and influenced educational reforms in several countries. Taking as its starting point the concern about the employability of young people, various organizations, such as the Organization for Economic Co-operation and Development (OECD), the World Bank and the United Nations Educational, Scientific and Cultural Organization (Unesco), have produced documents that point to the need for urgent reforms, especially regarding the educational organization and school curricula.

This article analyzes the work training practiced in Brazil in various levels of education, compares the Brazilian model of high school professional technical education with a few models adopted in other countries and lists

some challenges ahead for vocational education under the perspective of compliance with the Federal Constitution in its Article 205, states that:

Education, which is the right of all and duty of the State and of the family, shall be promoted and fostered with the cooperation of society, with a view to the full development of the person, his preparation for the exercise of citizenship and his qualification for work (BRAZIL, 1988).

## 2. Availability of personnel for work and innovation

Brazil structured its industrial development based on imported technology. For a long time, this condition as a technology importer allowed Brazil to use unskilled labor and practice competitiveness based on maintaining cheaper personnel costs.

By the last quarter of the 20<sup>th</sup> century, vocational training in Brazil was limited to the operational training for series and standardized production, with massive incorporation of semi-skilled workers. Workers had little room for autonomy and the decisions were made by managers that held the technological and managerial knowledge.

From the 70s and 80s of last century, several studies conducted in various parts of the world about the impacts of new technologies revealed the need for professionals that were increasingly versatile and able to interact in new situations, and in an environment subject to constant change. Companies now require more skilled and autonomous workers. According to these companies, the new functions require training that goes beyond the operational domain of a particular office, which allows the achievement of a comprehensive understanding of the production process.

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In recent years, Brazil changed its awareness of the need to invest in creating an innovative environment to promote economic development. The status of a country belonging to the ten largest economies of the world requires that Brazil quickly migrate from its position as a technology importer to that of a technology producer.

Therefore, the country needs to take into account that the accelerated innovation practiced by developed countries causes the obsolescence of industrial equipment and of the production processes and that, not wanting to be left behind, the country needs to invest heavily in education, conceived as a single and systemic process, from kindergarten to graduate school. It is essential to train high quality master's and Ph.D holders to lead cutting-edge

research; to train more engineers to translate scientific discoveries into new products and processes; and form a large number of technicians, as well as train their assistants to make industries in the country work with more quality.

The concept of innovation is slowly being incorporated into Brazilian investments. It has increased the number of technology parks as well as the number of business incubators. It has also increased the understanding that the use of science and technology as a source of wealth, it is crucial for demands of technology and innovation to be produced bearing in mind the needs of business projects and social policies. The understanding that the country needs to bring together academia and the company is on the rise.

Part of the relative success recently sustained with regard to approaching universities and businesses stems from a set of development tools, credit offer, grants and the creation of new laws to facilitate this approach by reducing the bureaucratic barriers.

Despite the growth seen in recent years, the percentage of doctors working in the industry is still small, at around 7.1%. This percentage small compared to Germany, which has 26.7%, United States 7.7%, Japan 14.2%, Korea 40.0% and Canada 63%. Besides that, in the United States and Germany, over 60% of spending on innovation is made by private businesses, while in Brazil, the investments made in innovation by the business sector, as a whole is less than 37% (SENAI, 2015).

According to a study by the Center for Strategic Studies and Management (CGEE) conducted based on 2010 Census data, Brazil has 187,354 doctors and 516,983 teachers, and 168,143 doctors graduated after 1996 (GALVÃO, 2016).

When comparing the number of doctors per 100,000 inhabitants in Brazil and other countries, it appears that there is still a great deficiency: while Brazil has 7.6 doctors per 100,000 inhabitants, Slovenia has 56.6; the United Kingdom, 41; Portugal, 40; Finland, 35; France, 21; and the United States, also 21 (GALVÃO, 2016). The total number of scientists and engineers in Brazil is 20 times lower than in the United States and Japan. This data can be related to the low number of patents registered in Brazil.

The training of human resources at the graduate level in Brazil is yet other scenario that needs improvement. Only 16.7% of young individuals from 18 to 24 years of age are enrolled in higher education. In Argentina, this percentage is 30%; Chile, 52%; and the United States, 60%. In addition, only 14% of Brazilian students enrolled in higher education are in Engineering, Production and Construction courses.

The National Education Plan (NEP) 2014-2024 establishes, in its target 12: “raising the gross enrollment rate in higher education to 50% and the net rate to 33% of the population between 18 to 24 years of age, ensuring the quality of offers and expansion to, at least, 40% of enrollment in the public sector” (BRAZIL, 2014). Achieving this goal will require a great effort by the entire society, be it with respect to the construction of new schools, be it in training and hiring new teachers or restructuring school curricula.

The lack of high school technical personnel is proportionally much greater than that seen in higher education. Data from the 2014 National Survey by Domicile Samples (NSDS) show that only 31.1% of Brazilian workers have completed high school (IBGE, 2015). Many times smaller is the percentage of those with technical professional education.

The percentage of enrollment in high school technical professional education in relation to total enrollment in high school education has increased since 2007 (11%), reaching the percentage of 19.1% in 2015. Of the 1,787,229 enrolled, 391,766 were in high schools that integrated vocational education, 1,023,212 in high schools that offered this training concomitantly and 93,919 in the normal/teaching modality. The analysis by administrative assignment shows that, of the total number of enrollments, 945,770 enrolled in public schools and 841,459 in private schools (INEP, 2016).

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The NEP for the decade 2014-2024 focuses on professional training, including initial training and continuing education of workers in its goals 8-11. Goal 8 proposes the raising the average educational level of the population between 18-29 years of age, to achieve at least 12 years of study in the last year of the NEP. Among the strategies established for achieving this goal is the expansion of the free offer of technical vocational education by private entities of social service, concomitantly to the education offered in the public school system.

In the strategies defined for achieving Goal 9, proposing to implement technology-training programs for the young adult population stands out.

Goal 10, in turn, determines offering at least 25% of enrollments in education for youth and adults in primary and high school, integrated with professional education.

Goal 11 proposes to triple enrollments in high school technical professional education. As a strategy, it proposes, among other actions, to use distance education.

### 3. Overall overview of high school professional technical education

The widespread dissemination of technologies and the increasingly frequent use of computers in production lines establish a direct relationship between changes in work processes and the need for greater professional training. This relationship creates a new link between the general education of the population and the economic development of countries. This new configuration highlights the need to invest in restructuring educational systems.

The identified challenges have the topics related to school curricula, management, and the increasing demands of companies and the relation to basic education in common.

The introduction of changes in the professional education model of a given country should greatly consider its historical evolution and vocation. This implies that it is not always possible to transplant an educational model from one country to another.

The information presented below on some educational systems have the sole purpose of offering subsidies for a comparative analysis of the Brazilian scenario (SENAI, 2015):

**England** - In England, the compulsory education is mandatory until the legal age of 18 years old. The preparation for work is an old practice. Such preparation began with the compulsory training of children in domestic work and agriculture. The English model is a decentralized model, which values work experience over certification. It has little involvement of the state, both in funding and in regulation.

The criticisms currently directed to the English model referring mainly to the decentralized system, which makes the control of the offers precarious, resulting in excess of professionals in certain areas while other areas are deficient.

Another criticism relates to the widespread of courses, which hinders student credit transfers in other courses or themes of related subject areas. Most options are unknown to students or companies. The model is in need greater integration with basic education that, in turn, provides unsatisfactory results.

**France** - The educational model adopted in France is state-owned. Since the state was strong, universal public school became the base of the aforementioned. The model is centralized and carried out mainly through public schools. The school is singular and reaches individuals of up to 14 years old. From 15 on, the students have various professional education and general education options. Students who get the best grades direct towards general and higher education. In the French education system, 37% of students opt for vocational education, particularly those students with lower assessment levels.

There is also vocational education aimed at adults, offered by another ministry, which in that country, is the Ministry of Labor in Brazil. The centralization and nationalization have been growing reasons for criticism.

**Germany** - The model is comprehended as dual. It combines preparation for work, both at school and in the company. The basic and professional education proportions can vary from region to region.

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In Germany, technical professionals are very prestigious. The demand for vocational education is high and exceeds 51%. Students opt for vocational education at the end of primary education (at 11 or 12 years old) which has received quite some criticism, especially because it considered too early for such a decision.

**United States** - The US educational system is highly decentralized due to the autonomy that each state holds in the Federation. The states have full autonomy to define their educational policies without direct interference of the Union.

The American educational system aims to ensure universal basic education, considered essential and necessary to obtain employment. A general feature of this system is the flexibility resulting from the adoption of the comprehensive school model, which allows the same school to prepare students for college, professional practice or offer a less demanding training for students with lower grades.

Regarding vocational training, the American model is rather old, being implemented in the 19th century. The schools assume the task of preparation students for work. The professional education is believed to be undermined by regular education because the latter is weak, particularly in relation to lower income students.

The latest recommendations made by experts of that country suggest increasing the use of workplaces by schools and improving skills in literacy and



math. The recommendations indicate that training needs to be increasingly longer and more complex.

**China** - In China, education is state-directed. The vocational education offer is limited, mainly because it is more expensive. In recent years, there has been an increase in the offer of education. This growth stems from some state actions. Polytechnic and vocational schools have been created.

Vocational education is being encouraged by establishing more flexible school management and adjusting the offer to market demands.

It is difficult to attract teachers to Vocational and Technological Education (VTE) because academic areas are more prestigious.

A few challenges currently identified by China can be highlighted, such as the need to improve cooperation between schools and employers; and the need to establish standards for training and internships.

**South Korea** - In Korea, elementary school starts at seven years of age and goes up to 12 years of age. Nursery school, which comes before, is optional. Elementary school goes from 13 to 15 years of age. Then, there is high school, "junior college" and university.

In the passage from elementary school to primary school (when the student turns 12 years old), there is a test that students take, and, depending on their results, those with the best scores are directed to academic schools and others to schools for the industries. When the students turn 18, those who wish to continue their studies can go to an academic college, get an associate degree or go to an industrial college.

Academic education has a strong appeal and absorbs the most talented students. As a result, the number of high school technical professionals is comparatively very small.

**Finland** - Education in Finland is prone to in-company training and valuing professional education from 16 to 19 years old.

Swaying between academic and vocational education is facilitated. At the same time as the country invests in vocational education, the students in regular education achieve the best results in the International Student Assessment Program (Pisa). Curricula value socio-emotional skills over cognitive skills.

The teaching career is highly valued and the requirements to teach in academic and professional education are the same. Professional training in

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Finland is facing problems because of the aging population and the decrease in number of young people. Therefore, the country invests in flexibility to allow students to attend more than one school.

The latest guidelines in Finland are raising and defining the qualifications of students of high school education in general; developing new processes and guidance counseling for young people; and enabling facilities for all to complete their courses.

These data show that the developed countries use three models: the model that values academic activities; the non-formal model, which offers programs of different compositions and lengths; and the so-called dual model, combining vocational education with work activities. Faced with the new requirements brought about by changes in the working world, they are all under pressure to make new adjustments.

## **4. Organization of high school technical professional education in Brazil**

The technical professional education model adopted in Brazil followed two distinct paths: the model of the Federal Technical Schools, which resembles the French model; and the Autonomous Social Services, inspired by the German model. The courses that, at first, were intended solely for vocational training, gradually incorporated components of formal education.

The vocational education funding comes mainly from the Federal Government, in the case of technical schools maintained by the Union. Lately, the government has invested beyond its Federal Network, in educational institutions run by the private sector, to offer technical courses in high school and vocational training, including initial and continuing training under the National Access Program to Technical Education and Employment (Pronatec), established by Law no. 12.513/2011 and complemented by Law no. 12.816/2013. In the case of courses offered by Social Services for the Self-employed, they are funded according to a specific system designed in the 1940s by the Getúlio Vargas government. It includes compulsory contributions from employers on the payroll of their employees for the maintenance of private entities of Social Services and Vocational Education, and are linked to the National Trade Union System in their private nature management, supervised by the Union. The so-called "S System" was subsumed and is based on Article 240 of the Constitution. Article 20 of Law no. 12.513/2011, amended by Law no. 12.816/2013 has set specific rules for incorporating these Professional Education Institutions in the federal educational system, as controllers, to also be able to receive specific funding for actions under

Pronatec, offering technical courses in high school and vocational training courses, including initial and continuing training of workers. In recent years, the provision of high school technical vocational education and its respective formation programs by state systems of education and science and technology have also increased.

The teaching standard offered by technical schools is considered of good quality, and the same occurs with the so-called “S System”, whose students have won awards in international competitions.

One of the critiques to the technical vocational education developed in Brazil is regarding to the fact that the number of students of vocational education is considered too small to boost the development of the country. Some say that the country knows how to produce very good business for few, but cannot extend these services to the majority of the population.

Despite the participation of states having grown in recent years, the percentage of enrollment in vocational education is still low and, consequently, so is the number of graduates in technical courses.

The low percentages of enrollment in vocational education has been attributed to various reasons, including the lack of appeal in professional education, lack of offer and unsatisfactory relationship with employability.

The quality of Brazilian vocational education is directly affected by the quality of basic education, known as regular. Shortages of basic education can be verified when it is observed that only 50% of people aged 15 to 17 years old (expected age) are in high school and when they finish high school, only 9% learned what was expected in mathematics.

The legal framework of vocational and technological education is set out in Articles 39, 40, 41 and 42 of the Law of Guidelines and Bases of National Education (LGBNE).

Art. 39 - The vocational and technical education, in compliance with the objectives of national education, integrates the different levels and types of education and dimensions of work, science and technology.

§ 1 The vocational and technological education courses can be arranged by technological axes, allowing the construction of different training routes, subject to the rules of the respective system and level of education.

§ 2 Vocational and technical education include the following courses:

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I - initial and continuing education or professional qualification;

II - high school level vocational technical education;

III - undergraduate and graduate technological vocational education.

§ 3 The undergraduate and graduate technological vocational education courses will be organized, regarding the objectives, characteristics and duration, according to the national curriculum guidelines established by the National Council of Education.

Art. 40 - Vocational education shall be developed in conjunction with regular education or different continuing education strategies in specialized institutions or in the workplace.

Art. 41 - The knowledge gained in vocational and technological education, including at work, may be subject to assessment, recognition and certification for the continuation or completion of studies.

Art. 42 - The institutions of vocational and technological education, in addition to their regular courses, offer special courses open to the community, with enrollment subject to the capacity of the student and not necessarily his or her level of education (BRAZIL, 1996).

In the case of high school level technical vocational education, it is also necessary to note that Law no. 11.741/2008 introduced a Section IV-A, entitled “The Vocational Education High School Technical” adding the following articles to the LGBNE, passed in 1996: 36-A, 6-B, 36-C, and 36-D.

Article 36-A – Without prejudice to section IV of this chapter, high school can prepare students for the exercise of technical professions, considering it also provides general education.

Sole paragraph. The general preparation for work and, optionally, professional training, may be performed in high school establishments themselves or in cooperation with specialized institutions in vocational education.

Art. 36-B – The high school level of technical vocational education shall be developed in the following ways:

I - combined with high school;

II - subsequently, in courses for those who have already completed high school.

Sole paragraph. The high school level technical vocational education shall observe:

I - the objectives and definitions contained in the national curriculum guidelines established by the National Council of Education;

II - the supplementary rules of the respective education systems;

III - the requirements of each educational institution in terms of its pedagogical project.

Art. 36-C – Articulated high school technical vocational education, provided for in item I of the heading of art. 36-B of this law shall be developed as follows:

I - integrated, offered only to those who have already completed elementary school, with the course being planned to lead the student to high school level technical professional training in the same educational institution, making up a single registration for each student;

II - Concomitantly, offered to those who enter high school or are already enrolled, making up separate registrations for each course, and which may take place:

a) in the same educational institution, taking advantage of the educational opportunities available;

b) in different educational institutions, taking advantage of the educational opportunities available;

c) in different educational institutions, through agreements of inter-complementary, aimed at planning and developing a unified educational project.

Art. 36-D – The diplomas of high school level vocational technical education courses, when registered, will valid throughout national territory and will enable further study in higher education.

Sole paragraph. High school level professional technical education courses, in the concomitant and subsequent articulated forms, when structured and organized in stages with termination, will make it possible to obtain training certificates aimed at work after completion with success of every step that characterizes work training (BRAZIL, 2008).

This same Law no. 11.741/2008 also introduced paragraph 3 of Art. 37 to the 1996 LGBNE, in Section V, which deals with the Youth and Adult Education, defining that “Youth and Adult Education must be coordinated, preferably with professional education, in the form of regulations”.

The analysis of the legislation shows that the Brazilian high school technical vocational education system is, in practice, a kind of dual system, which uses schools and specialized institutions.

B. Téc. Senac, Rio de Janeiro, v. 43, n. 1, p. 110-139, jan./abr. 2017.

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The Table below reproduces the information brought by the National Curriculum Guidelines for High School Level Vocational Education defined by the Opinion provided by the National Education Council/Chamber of Basic Education (NEC/CBE) no. 11/2012, and shows the means of offer defined and their corresponding workloads.

**Chart 1 - Forms of providing high school level technical professional education**

Form	Offer	Hours
Articulated Integrated	Integrated with regular high school education offered, at the appropriate age, in the same school.	Minimum of 3,000, 3,100 or 3,200 hours, for the school and the student, pursuant to the professional training offered.
	Integrated with the high school in the form of Youth and Adult Education (YAE) in the same school.	Minimum of 800, 1,000 or 1,200 hours pursuant to the professional training offered, plus another 1,200 hours devoted to general education, totaling minimum of 2,000 or 2,200 or 2,400 hours for the school and the student.
	Integrated with the high school under the National Vocational Education Integration Program with Basic Education in the Adult and Youth Education Modality (Proeja)	Minimum of 800, 1,000 or 1,200 hours pursuant to the professional training offered, plus 1,200 hours for general training, and must always add up to 2,400 hours for the school and the student.
Articulated Concomitant	Concomitant with regular high school, at the appropriate age, in different educational institutions, but with a unified educational project, by convention or an inter-complementarity agreement.	Minimum of 3,000, 3,100 or 3,200 hours for schools and students, pursuant to the professional training offered, similar to the provision in an articulated manner.
	Concurrent with regular high school in the same educational institution or in different educational institutions, taking advantage of the educational opportunities available.	Minimum of 800, 1,000 or 1,200 hours pursuant to the professional training offered in the vocational and technological education institution, plus over 2,400 hours in the high school institution, totaling a minimum of 3,200, 3,400 or 3,600 hours for the student.
	Concomitant with high school in the YAE modality, in the same educational institution or in different educational institutions, taking advantage of the educational opportunities available.	Minimum of 800, 1,000 or 1,200 hours pursuant to professional training offered in vocational and technological education institutions, plus over 1200 hours in high school units in the YAE modality, totaling 2,000, 2,200 or 2,400 hours for the student.
Subsequent	High school level vocational training offered after the completion of regular high school or YAE modality high school.	Minimum of 800, 1,000 or 1,200 hours for the student pursuant to professional training offered in vocational and technological education institutions.

Source: National Council of Education (2012).

The National Curriculum Guidelines for High School Level Technical Vocational Education, prepared by the National Council of Education, in addition to ratifying the decisions set out by the LDB, in Art. 6 of the Resolution CNE/CEB no. 06/2012, that vocational education should follow, among others, the following principles:

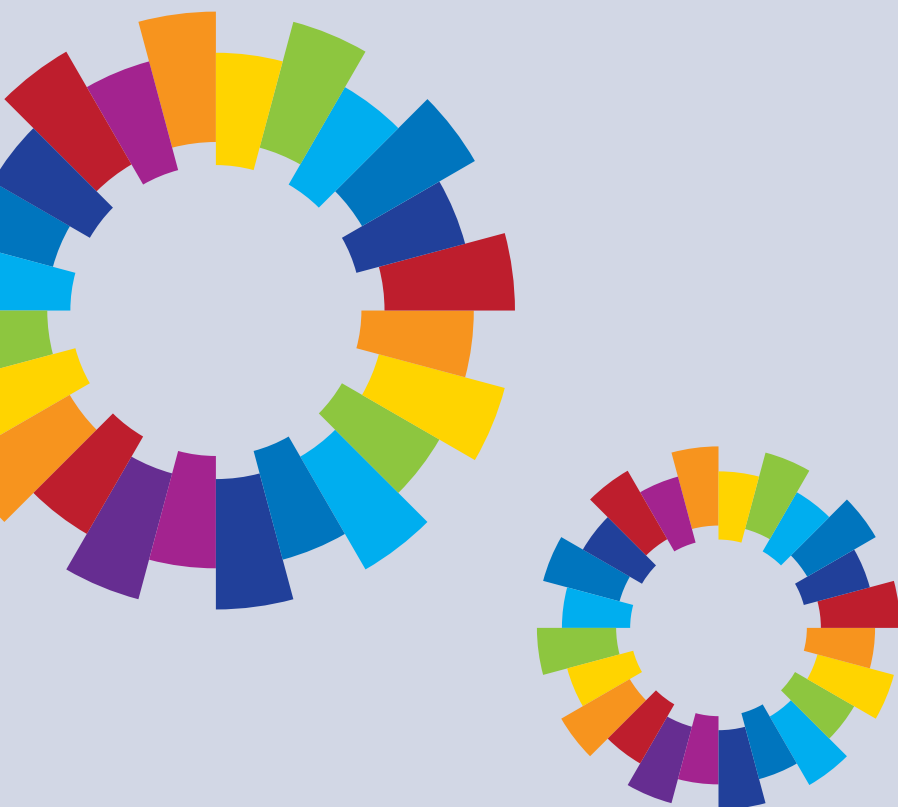
I - relationship and coordination between the training developed in high school and preparation for the exercise of technical professions, aiming at the integral formation of students;

II - respect the aesthetic, political and ethical values of national education, the development perspective for social and professional life;

III - work undertaken as an educational principle, integrated with science, technology and culture as the basis for the political-pedagogical proposal and curriculum development;

IV - articulation of Basic Education with Professional and Technological Education in the perspective of integrating specific knowledge to produce knowledge and social intervention, taking research as a pedagogical principle;

V - inseparability of education and social practice, considering the historicity of knowledge and subject of learning;



VI - inseparability between theory and practice in the teaching-learning process;

VII - interdisciplinary ensured in the curriculum and teaching practice, aiming at overcoming the fragmentation of knowledge and targeting curricular organization;

VIII - contextualization, flexibility and interdisciplinary in the use of educational strategies favorable to the understanding of meanings and integration between theory and experience of professional practice involving the multiple dimensions of the course's technological axis and the science and technology related to it (NATIONAL COUNCIL OF EDUCATION, 2012).

The high school level professional technical education courses are organized by constant technological axes in the National Technical Courses catalog, set up and organized by the Ministry of Education, covering one or more occupations of the Brazilian Classification of Occupations (BCO).

The National Professional Education Catalogues, both high school level technical courses and the undergraduate courses in technology, unite courses from the following technology areas:

- Environment and health
- Control and industrial processes
- Educational and social development
- Management and business
- Information and communication
- Infrastructure
- Military
- Food production
- Cultural production and design
- Industrial production
- Natural resources
- Safety
- Tourism, hospitality and leisure



## 5. The status of high school level technical vocational education in Brazil

Similar to what happens in other countries, high school level technical vocational education in Brazil is going through an evaluation process and suffers constant pressure to grow and improve its quality.

The enrollments have suffered an expansion, but the total is still considered as insufficient. The service and quality of high school level technical professional education is directly affected by the quality of regular education. This claim is easily verifiable when one observes that, of the 10 million people aged between 15 and 17 years old, only 5.3 million are enrolled in high school. More than 3 million are delayed or enrolled in primary education, and another 1.7 million are out of school.

Understanding these results is easier when they are analyzed from the point of view of Brazilian education's historical evolution.

President Nilo Peçanha created the federal technical schools, which received different names over time, in 1909, with the name of Craftsmen Apprentice Schools.

Decree no. 7.566, of September 23, 1909, created 19 schools in different units of the federation, intended for free primary vocational education. The mission of these schools was to train workers and supervisors through practical lessons. In 1926, a standardized curriculum was established for these artisan apprentice schools. In 1959, during the government of Juscelino Kubitschek, industrial schools were transformed into Federal Technical Schools.

The National Service for Industrial Apprenticeship (Senai) was created in 1942 to meet the needs of the industrial development, and inspired by the success of Senai, Senac was created in 1946 to meet the requirements of trade and service development. Throughout history, Social Services for the Self-employed incorporated other institutions to attend to other economic sectors. It currently has a wide network of vocational schools, laboratories and technology centers throughout the country. Most courses promoted by the so-called S System, in addition to the high school level technical courses and some undergraduate courses in Technology, are professional training courses, including the initial and continuing training of workers, providing professional development, or seeking to update or supplement their skills. Senai, for example, is considered one of the five largest complexes of vocational education in the world and the largest in Latin America. The Senai courses form professionals to 28 areas of industry, at levels ranging from professional to graduate training.

Table 1 shows the change in enrollment VTA by administrative dependency in the years 2007 to 2013. In this table, in regards to 2013, total number of enrollments in high school level technical professional education was 1,441,051. In 2014, total enrollment reached the figure of 1,741,528, which represents an increase of 23% over the previous year. When compared to enrollment in regular high school, it appears that in 2014, enrollment in vocational education accounted for 22.2% of the total (7,832,029). Of these enrollments, 48% were in private and 52% in public institutions.

**Table 1 - Changes in VTE enrollment (2007-2013)**

Year	Vocational Education Enrollment by Administrative Dependence				
	Total	Federal	State	Local	Private
2007	780,162	109,777	253,194	30,037	387,154
2008	927,978	124,718	316,404	36,092	448,764
2009	1,036,945	147,947	355,688	34,016	499,294
2010	1,140,388	165,355	398,238	32,225	544,570
2011	1,250,900	189,988	447,463	32,310	581,139
2012	1,362,200	210,785	488,543	30,422	632,450
2013	1,441,051	228,417	491,128	30,190	691,376

Source: INEP (2014).

The increase in enrollments in the period of Table 1 is the result of a series of actions taken by the Federal Government in partnership with state networks and the private sector, especially with the institutions of the "S System". These numbers are likely to continue growing as many schools are still under construction.

The Brazil Professionalized Program was created by Decree no. 6.302, of December 12, 2007, to stimulate the integrated high school education with vocational education, emphasizing the scientific and humanistic education, through the articulation between general education and vocational education in the context of productive clusters and local and regional capacities.

The Brazil Professionalized program provides financial assistance to states for the development and structuring of the integrated high school vocational education through selection and approval of proposals, formalized through the signing of agreements.

Because of this program, many states have opened vocational schools, thus increasing enrollment in this modality. Other schools are under construction.

The Federal Network Expansion Plan, carried out by the Federal Government since 2003, completed the construction of more than 500 school units. Recently inaugurated, they are receiving new students and this process will

result in significantly increasing enrollment in high school level technical professional education.

At the same time, the enrollment in courses aimed at initial and continuing education was boosted with the creation of Pronatec, focusing on the expansion within and on the democratization of the vocational and technical education courses offered in the country. This government program includes the development of five initiatives: the expansion of the Federal Network of Professional, Science and Technology Education; the Brazil professionalized program; The Tec Brazil network; Gratuity agreement with the National Learning Services; and Training Scholarship.

Courses for professional training of workers have workloads ranging between 160-400 hours. The Pronatec Courses Guide (BRAZIL, 2016) has 646 course denominations with their respective timetables, the definition of the professional profile and the respective associated occupations. According to the Ministry of Education, from 2011-2015, there were 9.4 million registrations through Pronatec (BRAZIL, 2016).

In sum, the vocational education system is booming. The increase in enrollments brings new challenges that need to be addressed so that this expansion is done in a sustainable way.

## 6. Challenges faced by high school level professional technical education

Reports produced by organizations such as the OECD, the World Bank and Unesco have pointed out that due to the imbalance caused by changes in forms of production, education systems need to promote reforms in secondary education to prevent the lack of training for work from serving as reason for the rise in unemployment.

Among the main recommendations brought by these reports, is that individuals should invest in their training, and education systems should increase the vocational education offer, providing courses that stimulate the ability to work in groups and to offer more general courses, allowing students to change jobs more easily and enabling individuals to prosper in competitive environments. They also suggest that the systems increase the connections with the productive sector and develop the attractiveness and appreciation of vocational education.

The need for a context that allows the vocational education in Brazil to be considered as undergone major changes in recent years confronts these recommendations with the Brazilian case.

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The challenges of high school level technical professional education in Brazil, as what happens in other parts of the world, holds a similar relationship with the general challenges of young people and depend on factors beyond the school. The enrollment opportunities offered are still small, as is the prestige of vocational education. The professional education strongly depends on the general education, which, in turn, is rather poor.

According to PNAD 2013, the population of young people between 15-29 years old is 48.8 million individuals (IBGE, 2014). This amount represents 24.3% of the population. Of this total, 21% are in the range of 15 to 17 years of age, 46% in the range of 18 to 24 years of age and 33% in the range from 25 to 29 years of age. Studies show that the population will start to decline from 2050, but will continue to grow until then, reaching the total of 233 million.

An opinion survey conducted by the National Youth Secretariat (NYS) in 2013 demonstrated that when asked what should happen in their lives to make them feel accomplished, 48% of Brazilian youth (15-29 years of age) marked the alternative work/employment. The same survey found that, in the opinion of these young people, the most important qualities to achieve employment are experience, level of education and vocational training. When asked regarding the actions that the government should take to improve the situation of young people professionally, they market the following: offer of vocational training; increase education and quality of education; and support entry into the labor market.

These data suggest that in addition to the challenges common to other countries, Brazil has challenges arising from the demographic issues and incomplete access to the general education that prevails today. The non-universal general education constitutes a bottleneck for professionalization.

The ENP 2014-2024, approved by Law no. 13.005 of 25 July 2014, sets targets for the expansion of high school level technical professional education:

Goal 10 – To offer at least 25% of youth and adults education enrollment in elementary and high school education, integrated with vocational education;

[...]

Goal 11 – To triple the enrollments in high school level technical education, ensuring quality and at least a 50% expansion in the public sector (BRAZIL, 2014).

The targets set in the ENP do not reflect the totality of the challenges faced by education because, in addition to the need for expansion, it is necessary to

discuss, among other issues, the social value of technical education and the creation of mechanisms to increase the attractiveness of professional careers.

The analysis of recent documents dealing with the development of public policies for vocational education leads to the identification of the following challenges:

- I – Increase the attractiveness and prestige of vocational education;
- II – Broaden the articulation of basic education with technical vocational education;
- III – Resize the curricula of technical vocational education;
- IV – Improve coordination with the productive sector;
- V – Strengthen and restructure the financing system;
- VI – Improve the management of schools and systems;
- VII – Recognize vocational distance learning;
- VIII – Encourage the recognition of professional knowledge and skills through certification;
- IX – Set a policy for teacher training in vocational education;
- X – Develop a specific evaluation system for professional technical education;
- XI – Build innovation strategies that reconcile citizenship with the employability of workers.

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## 6.1 EPT Attractiveness

Research conducted by the National Youth Secretariat (2013) shows that 48% of respondents put work/employment and education/school as life achievement goals.

This information leads to the conviction that, as important as improving the attractiveness of vocational education is to increase its offer. In this sense, goals 10 and 11 of the ENP, mentioned above, point in the right direction. The goals should be worked on in order to ensure quality.

The ENP establishes strategies for the achievement of goals 10 and 11, among which: for Goal 10 – to keep the youth and adult education program focused on the completion of elementary education; encourage enrollment in youth and adult education in order to articulate the initial and continuing training of workers through vocational education, aiming

to increase their level of education; implement the national restructuring program and purchase equipment aimed at expanding and improving the public school physical network that operate in integrated education to vocational education; stimulating curriculum diversification in youth and adult education, articulating basic training and preparation for the world of work and establishing interrelationships between theory and practice; promote the production of educational materials; implement mechanisms to recognize knowledge of youth and adult workers, to be considered in the curricular articulation of initial and continuing training and high school level technical courses (BRAZIL, 2014).

In order to triple the enrollment number in high school level technical professional education, i.e., for the achievement of Goal 11, the ENP has listed strategies, among which: to expand enrollment in the Federal Professional Education Network; expand the offer in state networks; expand the Distance Learning Program (DLP); expand the number of student loans granted to high school level technical professional education offered in private higher education institutions; and expand the offer of free high school education integrated with vocational education for the rural populations, in addition to indigenous and Quilomba communities (BRAZIL, 2014).

The increased attractiveness by way of expansion of this offer has been implemented through the construction of new technical schools and the entry of new state secretariats in the vocational training system, through adherence to the Brazil professionalized program.

The appreciation of the high school level professionals is one step ahead, as there is an excessive appreciation of higher education, especially undergraduate education.

## **6.2 Coordination of technical vocational education with regular basic education**

According to Article 40 of the LDB, vocational education will be developed in conjunction with regular education.

The regular high school will be responsible for general preparation for work, whilst the institutions that specialize in professional education will be responsible for professional training.

The professional training, when offered by the high school on a voluntary basis, cannot be an excuse for not fulfilling its main purpose, which is to provide the student with general education.

The National Curriculum Guidelines for High School Education and the National Curriculum Guidelines for High School Technical Professional Education (NATIONAL COUNCIL OF EDUCATION, 2012) define the relationship that should exist between the two modalities when establishing that “having ensured mandatory high school education, the schools can prepare students to exercise specific professions”. Likewise, complement this, stating that vocational education can be offered through the articulate or subsequent modalities, being that the articulate modality may be offered through integration or concomitantly.

The vocational education, pursuant current legislation, is an option that can be exercised by the student.

To facilitate the provision of professional training, the controlling institutions, either public or private, must verify the needs, possibilities and consequences of such offer. The next step may be establishing partnerships capable of enabling the chosen projects.

The experience has shown that the arising difficulties are due to the lack of conditions in schools and the lack of specialized teachers for the development of the proposed curriculum, rather than the lack of regulation.

### 6.3 Interaction with the productive sector

Recent studies show that the cause and effect relation between professional qualification and employability, often propagated as absolute, is less efficient than expected. This relationship depends on factors that are not found in the school, such as industrial policy and the adoption of new technologies by industries, financial speculation and trade relations between countries.

Thus, the productive sector should be approached to facilitate the practice of internships and other interactions, without, however, generating high expectations regarding jobs, but focusing on the improvement of the overall education quality. The rules that address internships need to be improved to enable companies to receive a greater number of students.

The workload that is intended for supervised internships should be added to the total workload of the respective course, except for courses of the articulated modality, integrated with secondary education in the form of adult education within Proeja, a program which has its own rules. The educational institution, the student and the grantor organization of the supervised internship should jointly establish an agreement, pursuant to the Law.

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**The productive sector should be approached to facilitate the practice of internships and other interactions**  
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## 6.4 Financing

Since it demands laboratories and equipment, and requires greater diversity of the professionals involved, vocational education is more expensive than general education. The result is that some systems prefer to invest in that general education offer.

To prevent these choices from causing difficulties for the necessary expansion of the offer, discussion on financing should be promoted, notably on the distribution of resources from the Fund for the Development of Basic Education and Valuing of Education Professionals (FDBEVEP) so that the resources for professional education are adequately covered.

## 6.5 Distance Learning

The LDB officiated the modality of distance learning as valid at all levels and types of education, except for elementary education, which must be face to face. On the other hand, it defines that distance learning can be used, in elementary school, as supplementary learning, or even in emergencies.

Decree no. 5.622/2005 features EAD as an educational modality in which the didactic-pedagogic mediation in teaching and learning processes occurs with the use of media and information and communication technologies, with students and teachers developing educational activities in different places and/or times (BRAZIL, 2005).

All principles and concepts that guide professional classroom education should be considered in the provision of education in the distance modality. The courses that can be offered are listed on the National High School Level Technical Course Catalog. The pedagogical project of distance learning courses may also provide educational support, practical laboratory and supervised training and completion of course work. The classroom moments and forms of assessment must be defined.

The supervision of classroom and distance processes, the efficiency of communication and information systems, the quality of teaching materials and the organization of specific learning environments are imperative to ensure the quality of distance learning courses. It is also necessary to ensure support and monitoring of students during their formative paths.

The presence of trained professionals in the contents of the curriculum components is another key requirement. When distance lessons are provided, the monitoring is performed through virtual teaching platforms, mentoring videos, different means of synchronous and asynchronous communication, as well as other resources.



By regulating the matter, Decree no. 5.622/2005 only mentions, but does not define the technical courses, hours reserved for evaluations, supervised internships and compulsory activities that require laboratories or other specific environments and does not set the periods for face time.

Resolution CNE/CEB no. 01/2016, based on CNE/CEB no. 13/2015 and Decree no. 5.622/2005, as amended by Decree no. 6.303/2007, with wording provided by Article 211 of the Federal Constitution and Article 8 of Law no. 9.394/1996, in compliance with Article 90 of the LDB, set National Operational Guidelines for institutional accreditation and to offer high school courses and programs, High School Level Youth and Adult Vocational Education, in Elementary and High School, in the distance learning modality, in a cooperation between the Education Systems. The mentioned resolution clarifies issued related to the workload designated for internships and assessment.

According to these normative guidelines, the supervised training must be entirely in face to face, as expected, and in accordance with the course outline. The workload is added to that planned for the training offered under the National Technical Courses Catalog, as well as the hours for the final evaluations that are performed. The professional practical activities are part of the training workload. As for mandatory workloads for face-to-face sessions, parameters must be set, distinguishing the courses of the Health segment from all others. The Health courses require a minimum of 50% of the classroom activities. In the other courses, it is admitted a variation between 20% and 50%, depending on the technological nature of the courses and the professional profile desired for each High School Technical Vocational Course.

## **6.6 Resizing of the curricula**

To follow the demands set forth by the professional world, the curriculum of vocational education must overcome the traditional reduction in preparation for work merely focused on the operational aspect, and ensure the presence of essential elements of the overall training of citizens.

The curriculum should enable the integration of the training to with the general education. Before learning the specific occupation, the worker needs to complete a basic education that accredits the exercise of citizenship.

A comprehensive training not only provides access to scientific and technological knowledge, but also promotes critical reflection on the cultural patterns and aesthetic references that manifest themselves in historical times and spaces.

The National Curriculum Guidelines for High School Technical Vocational Education suggest that the curriculum is organized in accordance with the four dimensions of human development: work, science, technology and culture. It is in this perspective that the average level of professional technical education courses is organized by technological axes found in the National High School Level Technical Course Catalog.

Regarding the appropriateness of curriculum, it is necessary to invest in the provision of more general courses, which allows the egress to be used in more than one specific task, thus increasing employment opportunities.

The adequacy of curricula should also consider the appropriate use of new information and communication technologies in the classroom and in the development of non-classroom activities.

The new curricula should focus on the development of activities that allow and encourage learning to learn.

## 6.7 Teachers training

The LDB defines in its Article 62 that the training of teachers for working in basic education shall occur in higher education, in full degree courses with teaching majors, in universities and colleges, admitted, however, that kindergarten and elementary teachers who teach in the first five years of that category may have technical high school teaching courses.

The requirement for full degree programs poses difficulties for educational systems that have the task of offering professional education courses, since the installation of such courses requires a significant number of specialized disciplines for which there are not enough licensed professionals.

Therefore, the Union must be responsible for coordinating the national education policy, to make a discussion on the mechanisms of teacher training and recruitment for vocational education, especially for specific technical disciplines.

The issue of teacher training for vocational education should focus on a specificity that distinguishes the training of teachers for regular basic education and teacher training for vocational education. The professors of education should be able to prepare the citizen to know how to work in a professional context that is increasingly complex and demanding. This is a key variable to distinguish the training of vocational education teachers from that of basic education teachers.

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A vocational education teacher should show both mastery over pedagogical knowledge considered necessary to conduct young people and adults in learning paths and to establish professional knowledge and skills, as well as the proper domain of the different disciplinary knowledge of the specific field in their area of knowledge, to be able to make relevant choices of content that should be taught and learned, so that graduates are able to respond, in an original and creative way, to the daily challenges of their professional and personal life, as a citizen worker. The professional education teacher training is not just to ensure mastery of the so-called disciplinary knowledge, which may well be acquired in undergraduate or technology courses, or even high school level technical courses. It also deals with the acquisition of pedagogical knowledge and knowledge relating to the dynamics of the labor market.

Vocational education requires the presence of professionals who are directly linked with the professional world in the productive sector on which the course focuses. However, the teachers need to be adequately prepared for the exercise of the teaching profession, both regarding to their initial training, as well as, the continued and ongoing formation, since the development of technical courses should be under the responsibility of specialists in the professional segment, with relevant didactic and pedagogical knowledge to guide their students in learning and the formation of professional knowledge.

It is necessary to urgently develop a teacher training policy for vocational education that supports the increase of enrollments that has occurred in this educational modality.

## **6.8 Evaluation of high school level professional technical education**

Article 41 of the LDB states that: “The knowledge gained in vocational and technological education, including at work, may be subject to assessment, recognition and certification for the continuation or completion of studies” (BRAZIL, 1996).

The General National Curriculum Guidelines for Basic Education indicate three basic dimensions of evaluation: evaluation of learning, internal and external institutional assessment and evaluation of basic education networks.

The evaluation of learning should be developed by the school, in accordance with its pedagogical project, and should have an educational character, to allow the students conditions to analyze their evolution and the teacher and the school, to identify difficulties and individual and collective potential. In the case of professional education, the assessment should focus on

monitoring activities related to the development of the professional activity related to the ongoing course.

The internal institutional evaluation is performed based on the educational proposal of the school, as well as its work plan, which should be evaluated systematically, in order to the institution analyze its progress and find aspects that deserve redirection. In the case of vocational education schools, matters related to employability and meeting the demands of the working world should be evaluated, among other aspects.

Regarding the evaluation of educational networks, which is the responsibility of the state, a professional education evaluation system should be developed contemplating the criteria used in regular basic education, but that is also able to capture the specifics of vocational training.

Such a system should consider the adequacy of curricula to the needs of companies, the employability of graduates and the work culture obtained by the students.

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## 7. Final considerations

Recent developments in the high school level technical professional education in Brazil suggests that the vocational education system is properly equipped to face the posed challenges. The regulatory apparatus favors curricular and organizational flexibility, society is convinced of the importance of the EPT in the development of the country; public and private institutions are expanding the offer and the business sector is increasingly seeking trained professionals.

Addressing the identified challenges depends mainly on the continuity of funding, the constant adaptation of curricula to enhancement wages of technical professionals and the continued investment in teacher training with specific training for Vocational Education.

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