

ARTICLE

## THE PEDAGOGICAL PRACTICE OF SUSTAINABILITY FOR TRANSDISCIPLINARITY IN VOCATIONAL AND TECHNOLOGICAL EDUCATION (VTE)

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**ABSTRACT:** This article emerges from concerns about the trajectory and potential of Vocational and Technological Education (VTE) in Brazil at a crucial moment in human history, the Age of Complexity, in which we have rapid transformations in the production ways and severe environmental implications. Some studies show that, in a few decades, people will not have only one profession; there will be a constant creation and disappearance of several occupations. Thus, there are predictions that, by 2050, a new class of people will emerge: the “unemployable”. Furthermore, social and economic problems certainly will cause environmental problems, which are at the core of sustainability. Considering this new scenario, since 2000, there have been worldwide efforts to achieve sustainable development goals, initially with eight Millennium Development Goals (MDGs) and, later, seventeen Sustainable Development Goals (SDGs). In this context, the objective of this article is to analyze sustainability practices as a possible way to achieve transdisciplinarity in VTE. Therefore, we discussed the concepts and peculiarities of VTE, transdisciplinarity, and sustainability. In an accelerated moment of transformations motivated by the Covid-19 pandemic, it is urgent to change the VTE project to keep up with the rapid changes in technology and economic, social, political, and cultural relations. We must take advantage of this unique moment in human history to remodel VTE contents and methodologies.

**Keywords:** integrated curriculum, continuing education for teachers, paradigm of complexity, active methodologies, sustainability, transdisciplinarity.

### SUSTENTABILIDADE COMO PRÁXIS PEDAGÓGICA PARA A TRANSDISCIPLINARIDADE NA EDUCAÇÃO PROFISSIONAL E TECNOLÓGICA (EPT)

**RESUMO:** A ideia deste artigo surgiu de inquietações sobre a trajetória e o potencial da Educação Profissional e Tecnológica (EPT) no Brasil, em um momento crucial da história da humanidade, a Idade da Complexidade, em que ocorrem rápidas transformações no modo produtivo, com profundas implicações ambientais. Estudos mostram que, daqui a algumas décadas, o indivíduo não terá uma única profissão, serão constantes a criação e o desaparecimento de várias ocupações. Por esse motivo, há previsões de que, até 2050, deva surgir uma nova classe de indivíduos: os “inempregáveis”. Com isso, obviamente, os problemas sociais e econômicos advindos de todo esse processo provocarão problemas ambientais, que são o cerne da sustentabilidade. Tendo em vista esse cenário vindouro, desde o ano 2000, tem havido esforços mundiais para o atingimento das metas do desenvolvimento sustentável,

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inicialmente, com oito Objetivos do Milênio (ODM) e, posteriormente, com dezessete Objetivos de Desenvolvimento Sustentável (ODS). Levando em consideração esse contexto de transformações, o objetivo deste trabalho foi analisar as práticas de sustentabilidade como um possível caminho para o alcance da transdisciplinaridade na EPT. Para tanto, foram observados e discutidos os conceitos e as peculiaridades da EPT, da transdisciplinaridade e da sustentabilidade. Em um momento acelerado de transformações motivadas pela pandemia da Covid-19, é urgente que o projeto da EPT se modifique para acompanhar as rápidas mudanças tecnológicas e das relações econômicas, sociais, políticas e culturais. Devemos, então, aproveitar esse momento ímpar na história da humanidade para desenvolver uma reforma ampla nos conteúdos e nas metodologias da EPT.

**Palavras-chave:** currículo integrado, formação continuada de professores, paradigma da complexidade, metodologias ativas de ensino, sustentabilidade, transdisciplinaridade.

## **LA SUSTENTABILIDAD COMO PRAXIS PEDAGÓGICA PARA LA TRANSDISCIPLINARIDAD EN LA EDUCACIÓN PROFESIONAL Y TECNOLÓGICA (EPT)**

**RESUMEN:** La idea de este artículo surgió de preocupaciones sobre la trayectoria y el potencial de la Educación Profesional y Tecnológica (EPT) en Brasil en un momento crucial de la historia humana, la Era de la Complejidad, en la que ocurren rápidas transformaciones en el modo productivo y con profundas implicaciones ambientales. Los estudios muestran que dentro de unas décadas el individuo no tendrá una sola profesión, la creación y desaparición de oficios será constante. Por esta razón, hay predicciones de que en 2050 surgirá una nueva clase de personas: los “inempleables”. Y, por supuesto, los problemas sociales y económicos provocarán problemas medioambientales, lo que constituye el núcleo de la sostenibilidad. De cara a este nuevo escenario, desde el año 2000, se han realizado esfuerzos a nivel mundial para alcanzar los objetivos de desarrollo sostenible, inicialmente con ocho Objetivos del Milenio (ODM) y, posteriormente, con diecisiete Objetivos de Desarrollo Sostenible (ODS). En este contexto, el objetivo de este trabajo fue analizar las prácticas de sostenibilidad como una posible vía para lograr la transdisciplinariedad en el EPT. Por ello, se visitaron y debatieron los conceptos y peculiaridades del EPT, la transdisciplinariedad y la sostenibilidad. En un momento acelerado de transformaciones provocadas por la pandemia del Covid-19, es urgente que el proyecto EPT sea modificado para mantenerse al día con los rápidos cambios en la tecnología y en las relaciones económicas, sociales, políticas y culturales. Debemos aprovechar este momento único en la historia de la humanidad para una reforma íntima en los contenidos y metodologías del EPT.

**Palabras clave:** currículo integrado, formación continuada de profesores, paradigma de la complejidad, metodologías activas, sostenibilidad, transdisciplinariedad.

## INTRODUCTION

The idea for this article was born from discussions during the application of an elective of special topics, in the professional master's degree in Vocational Education in National Network (ProfEPT- *Educação Profissional em Rede Nacional*), of the *Instituição Associada Instituto Federal do Paraná* (IFPR), in the second half of 2019. Through the interaction with professionals from different areas of knowledge, we could trace a line of reasoning that could direct the VTE on a safe path for sustainable development.

Sustainability was a hotly debated topic during the Covid-19 pandemic, as it was observed that structural changes are necessary in the economic, social, political, and cultural dynamics of the world community to ensure the continuity of life on planet Earth. The scale of certain environmental problems is global, and confrontations by all countries are necessary for a plausible solution, as soon as possible.

Given this new world reality, education becomes a fundamental part of changing the course of daily and professional attitudes. Individuals need to know what risks they are exposed to assertively, not just superficially. For these reasons, it is past time to modernize education, with innovative methodologies, contemporary content, and the use of technologies that accompany the evolution of humanity, with its consequent evils resulting from the current production mode.

The link between education and work is Vocational and Technological Education (VTE), the transformation must begin with this aspect. This process should take a few years to generate positive results, but it needs to start now.

Therefore, in this article, we try to answer the following questions: is there a way to advance in VTE, beyond the domain of techniques? What would be the differential of the professional of the future in transdisciplinary skills? Are there ways to develop such skills?

Thus, the objective of this work was to analyze sustainability practices as a possible way to reach transdisciplinarity in VTE. Therefore, we observed and discussed the concepts and peculiarities of VTE, transdisciplinarity, and sustainability.

## CONSIDERATIONS ABOUT VOCATIONAL AND TECHNOLOGICAL EDUCATION IN BRAZIL

According to the current legislation on Vocational and Technological Education, Article 39 of the Law of Guidance and Bases (LDB - *Lei de Diretrizes e Bases*), nº 9,394, of 1996, says that the VTE is the one that integrates the different levels and modalities of education to the dimensions of work, science, and technology (BRASIL, 1996). In this perspective, according to the Secretariat of Vocational and Technological Education of the Ministry of Education (SETEC/MEC- *Secretaria de Educação Profissional e Tecnológica do Ministério da Educação*), the VTE was based on the convergence of two basic rights of the citizen: the right to education and the right to professionalization (SETEC, 2021).

However, this convenient advantage of the VTE does not translate into a large number of vacancies in Brazil, as there is still great prejudice about this form of education because it is “culturally associated with poverty, with the perspective of servitude” (MORAES; ALBUQUERQUE, 2019, p. 7). To confirm this situation, Figure 1 shows 2018 data on vocational education from some Organization for Economic Co-operation and Development (OECD) countries and partners. On average, OECD member countries have 32% of students enrolled in the VTE, while Brazil ranks at the bottom with 8%, losing to Colombia (18%), Costa Rica (22%), and Chile (28%).

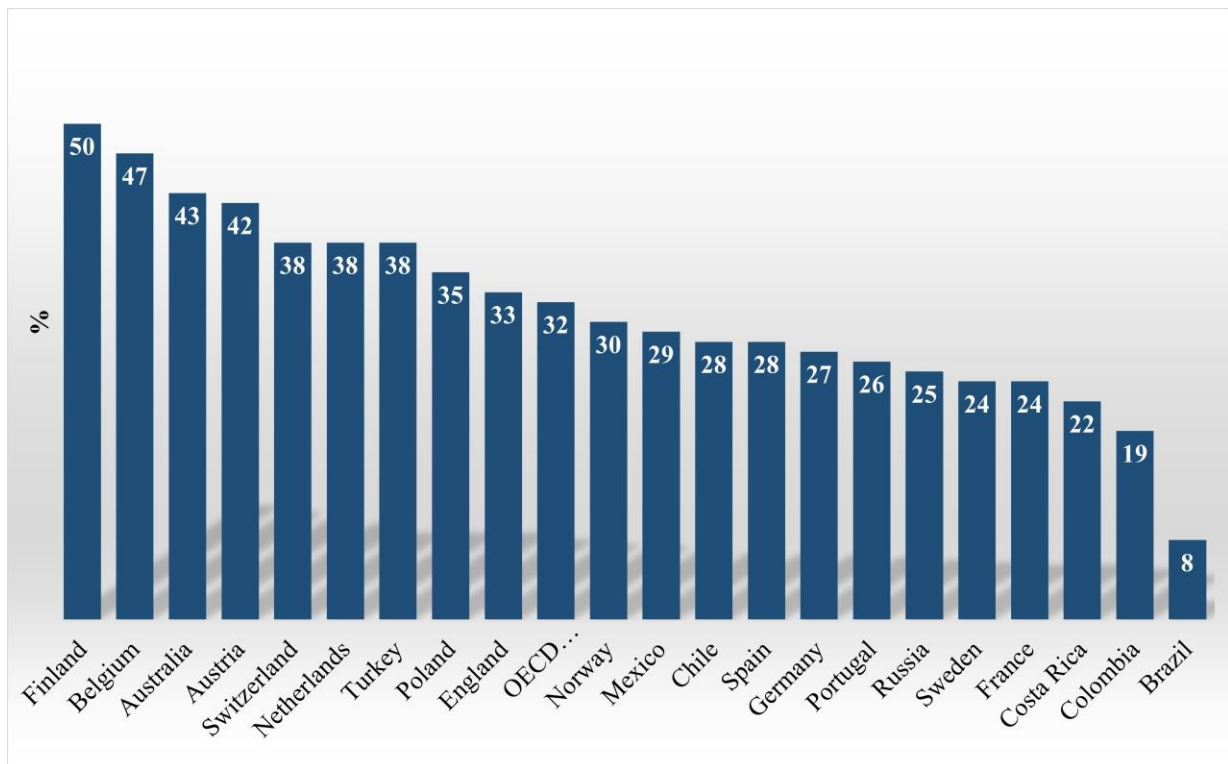


Figure 1 – Percentages of students enrolled in vocational education in some OECD and partner countries  
 Source: Our elaboration, based on Figure B7.1 from Education at a Glance 2020 (OCDE, 2020, p. 242).

Regarding the structure of the VTE, Paragraph 2 of Art. 39 of the LDB, included by Law n°. 11,741/2008, organizes the scope of the VTE in initial and continuing education courses (CEC), technical courses at the intermediate level, and undergraduate and graduate levels (BRASIL, 2008).

This breadth of educational levels is paradoxical, being the subject of controversies and discussions. On the one hand, the VTE can cover the entire economically active population. On the other hand, the VTE is a “parallel structure to the school system” (MORAES; ALBUQUERQUE, 2019), as the LDB defines only two levels of school: basic education, comprising early childhood education and primary and secondary education; and higher education (BRASIL, 1996, Art. 21). Moraes and Albuquerque (2019) showed this parallelism in Figure 2, which summarizes, in a simplified way, the Brazilian educational organization, proposed by Law n° 5,154/2004 (BRASIL, 2004).

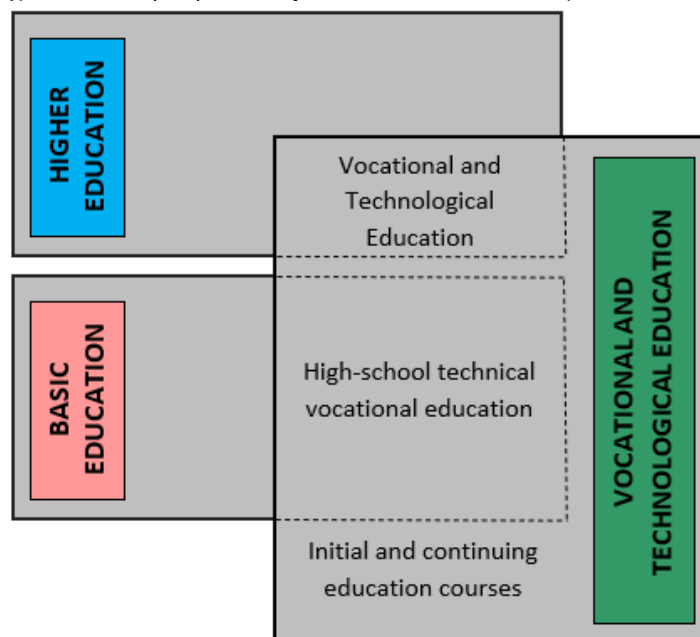


Figure 2 – Simplified structure of Brazilian education

Source: Figure copied from the text by Moraes and Albuquerque (2019, p. 17).

As a way to alleviate this “structural duality” of the VTE (KUENZER, 1989; CUNHA, 2005; FARIAS, 2019), the Federal Network of Professional, Scientific and Technological Education (Federal Network) was established and the Federal Institutes of Education, Science, and Technology (FIs) were created through Law n° 11,892/2008. This law introduced another dimension in the discussion of what VTE is and strengthened it, because, in the scope of the FIs, in addition to the already mentioned CEC and high school vocational education courses, the law explains as VTE the courses of higher education in technology, degrees, bachelors, and engineering, and *lato sensu* postgraduate courses for improvement and specialization and *stricto sensu* postgraduate courses for masters and doctorates, that is, it covers all levels of national education.

However, these courses will only be counted as VTE if they are offered by the Federal Network, which includes FIs, Federal Centers (CEFETs), Technical Schools linked to federal universities, and *Colégio Pedro II* (MORAES; ALBUQUERQUE, 2019). If a degree is offered, for example, by a private, state, or even federal university, statistics will not be generated for the VTE. If a vocational course is offered by one of the units of the S System<sup>2</sup>, a large number of enrollments is disregarded by the School Census since the initial and continuing training courses for workers are not included at a school level (MORAES; ALBUQUERQUE, 2019). In short, the conceptual difficulty remains.

Divergences and discussions aside, going back in the timeline of the VTE in Brazil, we arrive at the period of colonization, which places it in parallel development with the history of the country (SETEC, 2021a). As the nation is in full progress, the VTE is booming. In 2014, the goal of the National Education Plan (PNE- *Plano Nacional de Educação*) (BRASIL, 2014, p. 22), to be achieved by 2024, is “to offer at least 25% of enrollments in youth and adult education in elementary schools and secondary education, in an integrated way with vocational education”. Another daring goal of the PNE is to “triple enrollments in high school technical vocational education [...] and at least 50% (fifty percent) of expansion in the public sector” (BRASIL, 2014, p. 23).

Currently, the Federal Network has 654 educational units, 92.9% of which are federal institutes, 2.3% are CEFETs, 3.0% are linked technical schools and 1.8% are units of *Colégio Pedro II* (PNP, 2021). These data are available online on the Nilo Peçanha Platform (PNP- *Plano Nacional de Educação*), “a virtual environment for the collection, validation and dissemination of official statistics from the Federal Network” (PNP, 2021, p. 1).

According to the PNP (2021), in 2020, the Federal Network offered 898,787 vacancies in 10,878 courses. The teaching staff, in 2020, was 45,467, with 88.3% of permanent professors with exclusive dedication, 2.2% of 40 hours permanent professors, 1.4% of 20 hours permanent professors, 7.6% of 40 hours substitute professors (temporary), and 0.5% 20 hours substitute teachers (temporary). Most of these faculty have a master's degree (50.0%) and a doctorate (34.7%), and there is an incentive to leave full-time for teacher training.

Regarding the profile of graduates from the Federal Network in 2020, 86.8% were from CEC courses, 8.3% from technical courses, 2.6% from higher education courses, and the remaining 2.3% were divided into basic education courses and graduate. The technological areas that had the most enrollments in 2020 were Educational and Social Development (32.0%), followed by Management and Business (14.0%), Information and Communication (13.3%), Control and Industrial Processes (9.5%), Natural Resources (9.2%), Environment and Health (6.8%), Infrastructure (4.1%), Food Production (3.5%), Tourism, Hospitality and Leisure (2.4%), Industrial Production (2.1%), Cultural Production and Design (1.3%) and Security (1.1%) (PNP, 2021).

It is worth remembering that the S System also offers VTE courses, but they are not counted by the Nilo Peçanha Platform, but by the School Census or by surveys (MORAES; ALBUQUERQUE, 2019).

Despite the gap in Brazilian legislation and statistics for VTE, the importance of technical and technological courses for the professional and personal training of the individual and the progress of

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<sup>2</sup> Having the following units: Social Service for Commerce (Sesc), National Service for Commercial Training (Senac), Social Service for Industry (Sesi), National Service for Industrial Learning (Senai), National Service for Rural Learning (Senar), National Service Cooperative Learning Service (Sescoop), Transport Social Service (Sest), National Transport Learning Service (Senat) and Brazilian Support Service for Micro and Small Enterprises (Sebrae).



the nation is indisputable. Saviani (2007, p. 160) justifies that the “level of development reached by contemporary society places the demand for a minimum collection of systematic knowledge, without which one cannot be a citizen, that is, one cannot actively participate in the life of society”. Extending the author's discussion, supported by Antonio Gramsci, Karl Marx, and Mario Manacorda, that vocational and technological education must move “from the realm of necessity to the realm of freedom” (SAVIANI, 2007, p. 164), it is urgent to apply new methodologies and a new curriculum for the holistic development of skills and abilities, not only restricted to disciplinary content but also seeking to achieve and change the subject's perception, cognition or behavior. This concept is called transdisciplinarity.

## CONSIDERATIONS ABOUT TRANSDISCIPLINARITY

Contemporary society is complex. We can say that humanity currently lives in the Age of Complexity. The complexity paradigm, later abbreviated as the C paradigm, was introduced by Nicolescu (1999) based on the holistic context works of Naess (1973), Capra (1975, 1982), Maturana, and Varela (1984), Sachs (1986) and Boff (1993). In this new world scenario, scholars have contributed to defining, in a systematic way, the current understanding of the term complexity. According to Almeida Filho (2005), complexity can be understood by six interrelated elements: i) dynamism, ii) non-linearity, iii) chaos, iv) emergence, v) blurring and vi) fractality.

Dynamism is the characteristic of complexity, which comprises the “open systemic structures, in constant transformation, totalities formed by interrelated parts, elements, connections and changing parameters” (ALMEIDA FILHO, 2005, p. 35). This constant mutation happens in a non-linear way, that is, it is not predictable. Capra (2006, p. 117) explained that nonlinear dynamical systems are unstable, and critical points of instability are called “bifurcation points”. At these points, changes take place. The set of dynamism and non-linearity of complex systems leads to the idea of chaos, which, for this analysis, does not mean “mess” or “randomness”, but rather an organization in a deeper order. By analyzing the first three characteristics of complexity, we arrive at the fourth, which is both a cause and a consequence of the others: emergence, which can be translated as an unforeseen occurrence. The blurring, or diffusivity, translates the idea of imprecision of the limits of the elements of the system, that is, it is not possible to visualize where an element starts or ends (ALMEIDA FILHO, 2005). Finally, the most fascinating element of complexity, fractality, can be described geometrically as self-similarity, in which “the shape of the whole is similar to itself at all levels of scale” (CAPRA, 2006, p. 118).

In this context, Morin (2015) made it clear that complexity is not a solution, it is a problem. To solve it, it is necessary that the sciences, fragmented and reduced until the end of the 18th century, improve. Thus, with the beginning of the understanding of complexity, authors have taken their concepts to education, such as Georges Gusdorf, Jean Piaget, Basarab Nicolescu, Erich Jantsch, Edgar Morin, Ivani Fazenda, Hilton Japiassu, Mario Chaves, Naomar Almeida Filho, Eduardo Vasconcelos, among others (ALMEIDA FILHO, 2005; CHAVES, 1998; JANTSCH; BIANCHETTI, 2011; SANTOS; TEIXEIRA, 2015; NICOLESCU, 1999; SILVA, 1999; VASCONCELOS, 2002).

Although slow, an evolution observed in education is the way of producing knowledge, with discussions about the definition of the terms multi, pluri, inter, and transdisciplinary. There is still no consensus among authors on these definitions, but there is a tendency to understand. Silva (1999) reviewed Jantsch's model for knowledge production, which is the most widespread today and is complemented by Almeida Filho (2005).

The multidisciplinary study takes place when there is a juxtaposition of disciplinary units at the same hierarchical level, without coordination and cooperation or dialogue between specific knowledge. In multidisciplinary production, the object of study is analyzed by different disciplinary units, but even without coordination, there is a cooperation between the disciplines. The interdisciplinary approach is an evolution of the previous approaches, in which there is mutual enrichment of the disciplines when studying an object. Due to the presence of hierarchically superior coordination, the results have parts in common.

Currently, interdisciplinary analyzes are no longer sufficient for the study of the real world. With the approximation between neuroscience and education, the most appropriate term for application in teaching is transdisciplinary (FERREIRA; GONÇALVES; LAMEIRÃO, 2019), as it enables “a

dynamic exchange between the 'exact' sciences, the 'human' sciences, art and tradition” (UNESCO BRASIL, 2000, p. 174).

To organize the debate, in 1994, the Letter of Transdisciplinarity was published at the I World Congress of Transdisciplinarity, held in Portugal, which guided the discussions on the topic, encompassing the transdisciplinary approach to education, culture, economics, and ethics. Nicolescu, one of the writers of the letter, defined transdisciplinary as “what is at the same time between disciplines, across different disciplines and beyond any discipline” (NICOLESCU, 1999, p. 51).

From this perspective, we can say that the relationship between the concepts of complexity and transdisciplinarity was well defined in the words of Chaves (1998, p. 7): “complexity is to the real world what transdisciplinarity is to the academic world”.

This mode of intellectual construction was first used in the area of teaching health and mental health (VASCONCELOS, 2002) and, currently, has spread to several areas of knowledge.

As vocational and technological education aims to train critical, creative professionals, fully aware of being global citizens and prepared for the constant changes of the Age of Complexity, it is imperative that transdisciplinary be effectively achieved by an innovative curriculum. Thus, Pacheco (2012, p. 112) emphasizes that the construction of VTE curricula must consider “local arrangements, socioeconomic, environmental and cultural data and the potential for local development”. Supported by the National Environmental Education Policy (PNEA- *Política Nacional de Educação Ambiental*), the author proposes to strengthen environmental education in high-school technical vocational education, promoting sustainable management in the world of work, with the inclusion of the socio-environmental dimension in the curricula, as well as in teacher training and the development of teaching materials (PACHECO, 2012, p. 114).

However, in addition to secondary and environmental education courses, all levels of education of all modalities must have access to sustainability content, which unify the three main pillars: environmental, social, and economic. Through these topics, we could debate issues such as ethics, empathy, equity, peace, happiness, innovation, resilience, and flexibility, for example, which are covered by transdisciplinary.

## CONSIDERATIONS ABOUT SUSTAINABILITY

The National Education Plan, in force through Law n° 13,005/2014, establishes as an important education guideline the “promotion of the principles of respect for human rights, diversity and socio-environmental sustainability” (BRASIL, 2014, p. 2). This is the result of a global movement that has provoked international pressure since the 1970s when the environmentalist discourse began.

Over time, this debate took shape due to the understanding provided by scholars in the area, such as Naess (1973), Capra (1975, 1982, 2006), Lovelock (1979), Maturana and Varela (1984), Sachs (1986), Boff (1993) and, more recently, Francisco (2015) and Harari (2018). These philosophers, physicists, biologists, economists, theologians, historians, and other researchers have shown that concern for the environment, the health of planet Earth, and the perpetuation of life are not restricted to one area of knowledge, a convergent holistic understanding from all areas is needed.

With the idea that “a finite planet does not support an infinite project” (BOFF, 2014, p. 42), the concept of sustainable development was highlighted as being one “that meets current needs without compromising the ability of future generations to meet their needs” (ONU BRASIL, 2021, p. 7). As a way to achieve sustainable development, Elkington (1994) defined, for the first time, the term “sustainability”, in which institutions must stand on the tripod (Triple Bottom Line) of economically viable, socially fair, and environmentally correct.

Currently, other humanistic and ethical pillars have already been added to the standard model of sustainability, such as sustainable mind management, generosity, culture, and care (Boff, 2014). For this author, only sustainability understood and practiced in its entirety, is capable of guaranteeing the survival of human beings and other forms of life on the planet.

Due to the great importance of sustainability in the current global conjuncture, the United Nations (UN) published, 2015, the document entitled *Transforming our world: the 2030 Agenda for sustainable development*, presenting seventeen Sustainable Development Goals (SDG) and their 169

goals as responsibilities of its Member States. This publication was an expansion of the Millennium Development Goals (MDG), which were in force from 2000 to 2015. The seventeen SDGs are “integrated and indivisible, and they blend, in a balanced way, the three dimensions of sustainable development: economic, social and the environmental” (ONU BRASIL, 2021a, p. 14). Also, the UN understands that the SDGs encompass the areas of crucial importance for humanity, the five Ps: People, Planet, Prosperity, Partnerships, and Peace.

In this way, the seventeen themes of the SDGs are interrelated and they deserve to be explained: 1) no poverty, 2) zero hunger, 3) good health and well-being, 4) quality education, 5) gender equality, 6) clean water and sanitation, 7) affordable and clean energy, 8) decent work and economic growth, 9) industry, innovation, and infrastructure, 10) reduced inequalities, 11) sustainable cities and communities, 12) responsible consumption and production, 13) climate action, 14) life below water, 15) life on land, 16) peace, justice, and strong institutions, and 17) partnerships for the goals.

In this sense, efforts to achieve the goals of the SDGs must come from all people, individually or collectively, whether within companies, institutions, political organizations, or schools. From this perspective, quality education, as the basis of these efforts, becomes, at the same time, an objective and a means to achieve the other SDGs, being the only theme with this property. All the topics listed above must be worked on at school, at all levels and modalities, including the continuing education of teachers. In non-formal spaces, especially in the productive sectors of society, sustainability should also be pursued, as it is precisely at this end that, effectively, sustainable development happens, or not.

## **THE PEDAGOGICAL PRAXIS OF SUSTAINABILITY FOR TRANSDISCIPLINARITY AT VTE**

Based on the above reference, we can try to answer the questions formulated here. First, is there a way to advance VTE beyond the domain of techniques?

Amartya Sen (2010) explains, very clearly, that there is only development if there are freedoms: economic, social, and political. To complete this theory, we add Freire's (2013) idea that education brings freedom. Thus, completing the reasoning, education promotes development, both individual and collective. This freedom is precisely what makes the citizen choose his profession instead of being chosen to play a role in society, which normally does not remunerate him adequately, does not include him socially, and does not represent him politically.

In an accelerated moment of transformations motivated by the Covid-19 pandemic, the VTE project must be modified to accompany the accelerated technological changes and economic, social, political, and cultural relationships. This unique moment in the history of humanity should be taken advantage of for an intimate reform in the contents and methodologies of the VTE. It is time to add the SDGs to the pedagogical debate, as this new paradigm of sustainable development allows students to wake up and advance in their understanding of the future, both for their profession and for the planet.

Initially, this new curriculum proposal could contain a specific mandatory subject on the concepts of sustainability that is articulated with all the other subjects of the VTE courses. Subsequently, with the training of teachers along these lines, the principles of sustainability could be incorporated into all subjects, which would guarantee transdisciplinary.

What would ensure this transdisciplinary process would be the Ministry of Education as public policy, and this would discredit that the devaluation of education has been a government program since the Empire (RIBEIRO, 1986). Forming a contingent of unskilled, semi-enclaved, dependent and repressed labor is very cruel and immoral by those chosen to be in power. Sen (2010) demonstrated that the development of a country is not generated only with economic growth, because the Gross Domestic Product (GDP) has an owner, and the social and environmental costs do not appear when talking about GDP. As an example, it is possible to analyze the case of Brazil, which, before the pandemic, in 2019, had the 9th largest GDP in the world (TUON, 2020), while occupying the 84th position, among 189 countries, in terms of the HDI - Indicator for Human Development (UNDP, 2020). Brazil fell, in the GDP ranking, to the 12th position, in 2020, and should go to the 13th, in 2021 (ALVARENGA, 2021).

Therefore, this is a major challenge, especially as scholars predict that, by 2050, a new class of individuals will emerge: the “useless” or “unemployable” (CASTEL, 2010; HARARI, 2018). This



neologism can be understood as a category of individuals who will not only be unemployed but will also not be able to enter the world of work, as they do not have the minimum necessary qualities. We expect that the holistic training of all working classes, through sustainability and understanding of the SDGs, can alleviate these perverse predictions. In this sense, Boff (2014) guarantees that only an ecologically centered education would be humanely liberating and extremely democratic, which could transform this pessimistic scenario.

The second question to be answered is: what would be the differential of the professional of the future concerning transdisciplinary skills?

The development of cognitive and emotional skills could bring a clear advantage to VTE graduates in addition to technical disciplines: not being part of the new class of useless people. For historian Yuval Harari, in an interview with Timothy Ferriss (2019), in the not too distant future, subjects will need three main qualities to successfully face the occupational world: learning to learn, emotional intelligence, and resilience. For the author, each of these skills is intrinsically intertwined with the others.

The first attribute concerns continuous training and the ability to renew oneself for the successive changes that the pace of the 21st century imposes on us. Until recently, the individual had two phases in his life: the one of a student, in which he was preparing for the later phase; and the one of a worker, determined, almost immutably, by the previous phase. Currently, the two phases must be a student and student worker. For the second phase of the subject's life to be consolidated, it is necessary that, in the first phase, he, as a student, learns the value of permanent study and is stimulated to creativity, critical thinking, collective multidisciplinary work, and collaboration (HARARI, 2018). These last two are qualities that are very common in ecological relationships.

In a few decades, the individual will not have a single profession, the creation and disappearance of trades (occupations) will be constant. Thus, to accompany this change, it will be essential to achieve the goals of SDGs 4 (quality education), 8 (decent work and economic growth), and 9 (industry, innovation, and infrastructure).

It is important to highlight self-knowledge. In this sense, Socrates' maxim has never been more adequate: "know thyself". Perhaps this is the hardest lesson to learn, as we are not very used to seeing and accepting our flaws. We also need to look at each other with empathy, accepting their realities, differences, and limitations. With all the reflections that sustainability brings us, such as, for example, the contents of SDGs 5 (gender equality) and 10 (reduced inequalities), perhaps this is possible.

Self-knowledge introduces the second professional quality for the future, according to Harari (2018), which is emotional intelligence. According to Goleman (2011, p. 60), it is necessary to "intelligently use emotions". The contemporary professional world is marked by fierce competition between subjects, in addition to excessive pressure from its various actors. Much of this emotional situation has caused various mental illnesses, such as stress, depression, and anxiety, and their more extreme consequences, such as violence and suicide. The sense of sociability and affection for other forms of life and planet Earth must also be worked on throughout the individual's learning period. From this perspective, the understanding and practice of SDGs 3 (good health and well-being), 12 (responsible consumption and production), 14 (life below water), 15 (life on land), 16 (peace, justice, and strong institutions), and 17 (partnerships for the goals) could help to internalize transdisciplinary skills and, who knows, even correct possible distortions in family education.

With these two skills assured, the third, resilience, concatenates the previous ones to ensure the ability to positively face adverse everyday situations. According to several authors, for over forty years, human resilience has been studied as a factor in the emergence of negative experiences, such as wars, extreme poverty, mental illness, abuse, among others (SILVA; ELSEIN; LACHARITÉ, 2003). According to the researchers, this ability would result from the interaction of genetic and environmental factors, the latter being possible to be worked on at school, and not only at VTE, because the sooner the better the results. Sustainability, with its three fundamental pillars (environmental, social, and economic), enters this debate as an example of resistance and survival over the ages.

As a third point for reflection, we can still answer the question: are there ways to develop such skills?

The first consideration regarding this investigation is the continuing education of teachers. It is necessary to break the reproductive cycle of teacher preparation along the lines of past centuries and

include interdisciplinarity and transdisciplinarity in teacher training courses. The possibility of promoting a conversation between the different areas of knowledge and the attempt to propose integrated activities from different disciplines can prove to be very attractive and fun for teachers. During this exercise, educators would experience doses of creativity, empathy, collaboration, and minimal management of emotions. The proposal for continuing teacher education in Mazzeu's (1998) historical-social perspective is still current and has a strong relationship with the assumptions of sustainability. The author proposes five steps as a pedagogical process, the first and the last being the same, as the beginning and end of a circle: social practice, problematization, instrumentalization, catharsis, and social practice.

In VTE curricula, active methodologies are a way to go, as this student-centered approach gives them autonomy, critical thinking, flexibility to change, engagement, organization, team spirit, and unity, among other skills necessary to guarantee a worthy craft (BACICH; MORAN, 2017). Several techniques can be taken to the planning of disciplines in an interdisciplinary way, such as problem-based or project-based learning (CASTAMAN; TOMMASINI, 2020), blended teaching (CHRISTENSEN; HORN; STAKER, 2013), the flipped classroom (BERGMANN; SAMS, 2016), peer instruction (MAZUR, 2015), gamification (FARDO, 2013), educational games (SILVA et al., 2021), maker culture (DOUGHERTY, 2012) and STEAM education (MARTINEZ, 2017). A quick survey on digital platforms proves that there are several reports of successful practices, especially activities that involve teaching-research-extension in sustainability (ARRUDA et al., 2018; GRANDISOLI, 2018; MAYWORM; FERREIRA; NERIS, 2017; PEREIRA, 2021), especially in the VTE (PEREIRA, 2020).

As the VTE already presupposes “sustainable territorial development actions”, with “the integral formation of emancipated workers-citizens” (SETEC, 2010, p. 14), there is a perfect alignment between sustainability and transdisciplinary. The term sustainable territorial development (STD) is still amorphous, but it is based on the concepts of eco-development by Sachs (1986, 2007). He proposes an effort to plan development considering the social, economic, ecological, spatial, and cultural dimensions. The “territory” can be understood as the politically and administratively delimited space, or as a geographic area that is consolidated from the meeting of social actors who seek to diagnose and solve common problems (CAZELLA, 2006). Due to the new complexity paradigm, territories are expected to develop considering the inseparability between social and natural systems, strengthening local sustainable productive arrangements (TIEPOLO; DENARDIN, 2016). Currently, the Federal Network is capillarized with one unit for every nine municipalities in the country, roughly speaking (PNP, 2021), it is hoped that the VTE will enable society to effectively participate in the development, planning, and territorial management.

All actions in this last discussion are directly related to SDG 4 (quality education), considering that, on this subject, the UN has as its premise “to ensure inclusive and equitable and quality education, and to promote learning opportunities throughout life for all” (ONU BRASIL, 2021a).

## FINAL CONSIDERATIONS

From the considerations of this article, we concluded that, in Brazil, the VTE is the target of some controversies, but it is a niche with great potential to transform the country into power in sustainable development since this is the world trend for the near future.

Thus, the student worker of tomorrow will stand out if he can develop and train transdisciplinary skills, which will probably give him the chance to choose whether he has an aptitude for manual or intellectual work, and develop them in the best way, with the possibility of altering the production method, if necessary.

For this, there are some means, but the path of sustainability is defended, as it is the way the world has faced the new paradigm of complexity. This movement can be implemented by changing two dimensions: teachers and the VTE structure.

Therefore, first, that teachers should constantly reflect on their pedagogical practices and incorporate sustainability activities into their classes. This task is unfinished and it is always possible that the activity will be different, as the classes are different and so are the students. In the same sense, the teacher is also different each year, as he has already changed with the previous activity and with the discussions with his former students. This task will only be carried out if the teacher manages to invest

in their continuing education, either through personal action or through the school's encouragement and practice.

Together with this, there must be a significant reformulation of the VTE curriculum; financial incentives for research, extension, and innovation in sustainability; encouraging active methodologies, and dissemination of the benefits of the VTE for the future of our nation. For this second dimension, once again, the emphasis is placed on the development of public policies. This is an important way to achieve the current and future goals for the desired sustainable development.

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## DECLARATION OF CONFLICT OF INTEREST

The author declares that there is no conflict of interest with this article.

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