ARTICLE

DESIGNING THE TEACHING WORK ACTIVITY SYSTEM IN PROFESSIONAL EDUCATION: DIMENSIONS OF ANALYSIS[1]

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ABSTRACT: This article aims to analyze the teaching activity in Vocational Education based on the assumptions of the Cultural- Historical Activity Theory (CHAT). To this end, we carried out an observation of classes over a semester and conducted interviews with two teachers of a vocational course offered by an institution of the Federal Network of Professional, Scientific, and Technological Education of Minas Gerais. From the data collected, we analyzed the teaching work and systematized its dimensions in an Activity System, based on studies developed by Leontiev (1978) and Engeström (2002, 2013, 2016) about CHAT. Finally, we conclude that an approximation of the work activity is essential to elaborate a teaching work activity system. This would make it possible to fill each of the system's poles and point out the singular aspects related to the experiences and values of each subject, which permeate the activity and go beyond what can be systematized.

Keywords: Activity Theory, teaching work, vocational education, activity system.

TRAÇANDO O SISTEMA DE ATIVIDADE DE TRABALHO DOCENTE NA EDUCAÇÃO PROFISSIONAL: DIMENSÕES DE ANÁLISE

RESUMO: Este artigo tem como objetivo analisar a atividade de trabalho docente na Educação Profissional e Tecnológica a partir dos pressupostos da Teoria da Atividade de perspectiva histórico-cultural. Para tal, realizamos a observação das aulas ao longo de um semestre e entrevistas com dois docentes de um curso técnico de nível médio ofertado por uma instituição da Rede Federal de Educação Profissional, Científica e Tecnológica de Minas Gerais. A partir dos dados coletados, procedemos a uma análise do trabalho docente e sistematizamos suas dimensões em um sistema de atividade, baseando-nos nos estudos desenvolvidos por Leontiev (1978) e Engeström (2002, 2013, 2016) acerca da Teoria da Atividade de perspectiva histórico-cultural. Por fim, concluímos que, para a elaboração de um sistema de atividade de trabalho docente, é fundamental uma aproximação da atividade de trabalho, o que viabilizaria o preenchimento de cada um dos polos de tal sistema, bem como evidenciaria a existência de aspectos singulares, relacionados, sobretudo, à experiência e aos valores de cada um dos sujeitos, que perpassam a atividade e ultrapassam aquilo que pode ser sistematizado.

Palavras-chave: Teoria da Atividade, trabalho docente, educação profissional e tecnológica, sistema de atividade.

DIBUJANDO EL SISTEMA DE ACTIVIDAD LABORAL DOCENTE EN LA EDUCACIÓN PROFESIONAL: DIMENSIONES DE ANÁLISIS

RESUMEN: Este artículo tiene como objetivo analizar la actividad del trabajo docente en la Educación Profesional y tecnológica desde los presupuestos de la Teoría de la Actividad en una perspectiva histórico-cultural. Para ello, realizamos la observación de clases durante un semestre y conducimos entrevistas con dos profesores de un curso técnico de enseñanza mediana ofrecido por una institución de la Red Federal de Educación Profesional, Científica y Tecnológica de Minas Gerais. A partir de los datos recolectados, se procedió a un análisis del trabajo docente y se sistematizó sus dimensiones en un Sistema de Actividad, a partir de los estudios desarrollados por Leontiev (1978) y Engeström (2002, 2013, 2016) sobre la Teoría de la Actividad desde una perspectiva histórico-cultural. Finalmente, concluimos que para la elaboración de un sistema de actividad laboral docente es indispensable una aproximación a la actividad laboral, que permita llenar cada uno de los polos de tal sistema, así como evidenciar la existencia de aspectos singulares, relacionados, sobre todo, con la experiencia y los valores de cada uno de los sujetos, que pasan por la actividad y van más allá de lo que se puede sistematizar.

Palabras clave: Teoría de la Actividad, trabajo docente, educación profesional y tecnológica, sistema de actividad.

INTRODUCTION

The last few decades have increased the number of research that is concerned with analyzing the work of teachers at different levels and modalities of teaching. This fact can be evidenced, for example, through the works available in the CAPES Catalog of Theses and Dissertations, in which we verified, by searching for the keyword "teaching work" (*trabalho docente* in Portuguese), that 311 studies dealt with this topic in 2021, in contrast to the 238 studies carried out in 2010. This concern can be traced, at least partially, to the concern with teaching professionalization, which requires the recognition of teaching as a unique profession constituted by specific knowledge. In this context, it is necessary to develop research and forms of analysis of teaching work that propose an approximation of teachers' work activity and that can reveal the dimensions and contradictions that permeate such work activity.

We can say that the issue of teaching work and knowledge began to be addressed in Brazil in the 1990s, with the publication of an article by Tardif, Lessard, and Lahaye (1991), which focused on problematizing the specificity of teaching work and their knowledge (BORGES; TARDIF, 2001; ALVES, 2007; among others). Thus, in line with studies developed in the field of Studies about Work, the discussion about teaching work present in the studies of Tardif and his peers is marked by consideration of its complexity and unpredictability. Such characteristics are attributed to the interactive dimension strongly present in teachers' work (TARDIF; LESSARD; LAHAYE, 1991; TARDIF, 2002; GAUTHIER; TARDIF, 2010; TARDIF; LESSARD, 2011). Within this perspective, in their work activity, teachers combine elements of social order, imposed on school institutions and their workers, and a "constructed order" through the relationships established between teachers and students (TARDIF; LESSARD, 2011).

Within the scope of the social order, it is considered that teaching work is subject to impersonal, general, abstract norms, drawn up by the State and which concern the objectives of teaching, the contents to be taught at each school stage, the compulsory attendance school, the management structure, the working hours, among others (TARDIF; LESSARD, 2011). In the other hand, the "constructed order" is understood as the teacher's work influenced by their work context, by the possibilities of adjustment between norms and the reality of the classroom, and by the interactions established between teachers and students. These elements of the constructed order refer to the reality of the teacher's work inserted in an environment that offers possibilities and limitations. At the same time, they also talk about subjective factors, such as the personality and values of teachers, which guide how the teacher carries out his work in interface with different students.

Despite important advances in the field of study of teachers' work, Cunha and Alves (2012) point out as a limitation of such research, despite having different approaches, the fact that they focus their reflections mainly on the assumptions of action theory. According to the authors,

"The problem with theories of action is that [they] are too restricted for understanding the complexity that appears and is produced in human work, as it goes beyond the logic of action, of the verbalizable, of rational discourse than can be visualized" (CUNHA; ALVES, 2012, p. 22). Therefore, it is necessary to develop studies that recognize the complexity of human work and establish an approximation of teaching work activity (TARDIF, 2002; CUNHA; ALVES, 2012). Given this, in this article, we aim to analyze the teaching work activity in Vocational and Technological Education based on the assumptions of the Activity Theory from a historical-cultural perspective.

The methodological path for constructing this article was outlined based on a bibliographical review of academic research that mainly addresses Activity Theory, Secondary Technical Vocational Education (EPTNM- *Educação Profissional Técnica de Nível Médio*), and teaching work within this level of teaching, as well as the starting from semi-structured interviews and direct observation of the work activity of two Vocational and Technological Education (EPT- *Educação Profissional e Tecnológica*) teachers. The data collected were analyzed based on the theoretical assumptions studied, contributing to the understanding of teaching work at EPTNM.

The observation of work activity was carried out through the monitoring of two teachers responsible for teaching subjects from the specific part of the curriculum – that is, subjects of a technical nature – to students on a secondary-level vocational course at an institution in the Federal Network of Vocational, Scientific, and Technological Education, the Federal Center for Technological Education of Minas Gerais (CEFET-MG- *Centro Federal de Educação Tecnológica de Minas Gerais*). The observation of the activity carried out for this research falls within the scope of "unstructured observations", characterized by not delimiting or predicting which behaviors should be observed, aiming to describe and understand what occurs in each situation (ALVES-MAZZOTTI; GEWANDZNAJDER, 1999). This type of observation aims to provide "immediate access" to the behaviors of research subjects, helping to identify the procedures adopted, acts, and gestures when they occur. However, Guérin et al. (2001) warn us that, even without defining the aspects that will be observed, the descriptions of the observations are not neutral and are based on what the researcher considers important for analyzing the work. Therefore, considering this reservation from Guérin et al. (2001) and the importance of observation for the study of teaching work, we observed 33 classes taught by the two teachers, held over a semester, in which we recorded the aspects that permeate the work activity of these teachers. Each class lasted 1h40min, which totaled 55 hours of observation of teaching work activity.

The first teacher observed, named Carlos[2], from that moment onwards, is responsible for teaching the subjects of Computer Network Design and Computer Network Design Laboratory (LPR) – the first of a theoretical nature, and the second practical – for 3rd-grade students of a secondary vocational course. The second teacher, Adriano[3], is responsible for teaching the Fundamentals of Computer Science Laboratory classes to first-grade students of the same course.

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[2] Fictitious name.
[3] Fictitious name.

Additional data was collected through semi-structured interviews with the teachers presented above. The interviews were carried out at the end of the observation period, aiming to elucidate issues highlighted during the observation, as well as to clarify important aspects of the dimensions of teaching work.

The information obtained through the interviews was organized based on the assumptions of content analysis, which consists of a set of:

> [...] communications analysis techniques aiming to obtain, through systematic and objective procedures for describing the content of messages, indicators [...] that allow the inference of knowledge regarding the production/reception conditions (inferred variables) of messages. (BARDIN, 2004, p. 42).

Bardin (2004) organizes content analysis into three stages: pre-analysis; exploration of the material (coding, classification, and categorization); and treatment of obtained results and interpretation. In this research, the data were previously analyzed and subsequently classified, considering theoretical assumptions of Activity Theory, aiming to highlight the aspects that constitute poles of teaching work activity. Finally, we analyzed the information obtained through the interpretation of the teachers' statements, based on the theoretical framework covered.

Added to this, aiming to theoretically substantiate this investigation, we carried out bibliographical research in productions that address Activity Theory, primarily contemplating the works developed by Leontiev (1978) and Engeström (2002, 2013, 2016), as well as in productions that they address secondary-level technical vocational education and teaching work within this form of teaching. It is also important to highlight that this article is the result of the doctoral thesis entitled *The Policy of Recognizing Knowledge from the Point of View of Teaching Work Activity in Vocational Education - A política de reconhecimento de saberes do ponto de vista da atividade de trabalho docente na educação profissional* (LIMA, 2019) and that the research presented here was registered with the Ethics Committee in Research (COEP) under number 68631717.0.0000.5149, approved through opinion 2.132.0338.

In this article, first, we present a brief history and the primary aspects of Activity Theory, before proceeding with the analysis of the activity. Based on observations and interviews with CEFET-MG teachers, based on the contribution of Activity Theory and studies on EPTNM, we propose the development of a teaching activity system in this teaching modality. Furthermore, we present the evidence that allowed us to make such a delimitation, as well as point out aspects inherent to teaching work that go beyond the poles of an activity system. Based on the analysis of the collected data and the theoretical framework, we conclude that the elaboration of a work activity system only becomes possible through a detailed approach to the work activity, which makes it possible to complete each of the poles of such a system, as well as making it possible to highlight the existence of singular aspects, related, above all, to the experience and values of each subject, which permeate the activity and go beyond what can be systematized.

METHODOLOGICAL APPROACH: ACTIVITY THEORY

Activity Theory is a field of study of historical-cultural psychology that was developed by Leontiev and deepened by Engeström (2002, 2013, 2016), based on Vygotsky's work, throughout the 20th and 21st centuries. This theoretical current is based on Marxist dialectical materialism and is concerned with analyzing the formation of the subject based on the interconnection between individual and social dimensions.

In this scope, we can say that Vygotsky's concern with developing a theory focused on considering how social, cultural, and historical aspects produce and influence the development of human beings is the foundation for the elaboration of the Activity Theory. In the works of this author, the treatment of activity appears based on the "social theory of activity" of Marx and Hegel. Praxis gains centrality, being responsible for explaining the social and historical character of human development, and the activity becomes understood as an "explanatory principle" in the field of psychology (KOZULIN, 1996). In this way, activity was taken by Vygotsky as responsible for mediating man's relationship with the outside world, as well as an extract of reality capable of explaining the development of individual consciousness (BURGESS, 1994; COLE 1996; KOZILIN, 1996).

Leontiev was the author responsible for developing an Activity Theory. In this context, the author proposed that activity is how the relationship between the subject and the outside world occurs and that this activity it is constituted as a system with its own structure, which undergoes internal transformations and develops in a specific way (LEONTIEV, 1978).

Leontiev's work, like Vygotsky's, aims to challenge the assumptions of behaviorist psychology. However, while Vygotsky focuses on studying the role of signs as mediating tools for the formation of consciousness and thinks about activity from the individual dimension, Leontiev focuses on considering activity, highlighting the importance of the collective for the development of thinking (CENCI; DAMIANI, 2018). According to the author,

> [...] the individual activity of the human being represents a system that includes the system of social relations. Outside of these relationships, human activity simply does not exist. The specific form in which it exists is determined by the material and mental forms and means [...] that result from the development of production and that cannot be perceived in any other way than in the activity of concrete people (LEONTIEV, 1978, p. 51, our translation).

Given this conception that individual consciousness can only be understood from the activity, Leontiev will establish that all activity is oriented by an object and driven by a need by the subject of the activity. The object comprises the reason for the activity, which can be "[...] material or ideal, present perceptually or exist in imagination or thought" (LEONTIEV, 1978, p. 62, our translation). The author further states "The main point is that behind the activity there must always be a need, [and that the activity] must always respond to one need or another" (LEONTIEV, 1978, p. 62, our translation). In this scope, the condition for the need to acquire a guiding and regulating

function of the activity is its encounter with the object, which was called "objectified need" by Leontiev (1978). According to Lima (2019, p. 128):

> This implies that the object "fills" the need with content derived from the world in which the subject is inserted, causing the need to move from the corporal to the psychological and become responsible for directing the activity. In this context, the development of society changes the object of activity and, consequently, human needs.

In addition to conceptually defining the objects, motives, and needs of activities, Leontiev (1978) proposes the structure for the activity, which would be constituted by actions driven by specific objectives (goals) and operations related to the instrumental conditions of its accomplishment. Activity only exists in the form of a group of actions that have an established beginning and end and which, however, despite having a consciously defined objective, are not capable of satisfying a need. These actions derive from operations, which concern the objective and material conditions present in an environment (LEONTIEV, 1978; CENCI; DAMIANI, 2018).

Thus, Leontiev (1978) defines that to analyze the activity, it is necessary to study the connections between it, the actions, and the conditions. However, it reaffirms that, with this understanding, activity theory does not aim to list or hierarchize its elements, but rather "[...] reveal the internal relationships that characterize human activity, since it is considered that the transformations that occur in activity are 'hidden' in these relationships" (LIMA, 2019, p. 130).

In his research, Leontiev also addresses the processes of internalization and externalization responsible for the formation of consciousness. However, given the objective of this article, we chose not to delve into this topic, without disregarding its importance, and moved on to the development of Activity Theory by theorists of its third generation, represented, above all, by Engeström and his peers.

When trying to advance the proposition of an Activity Theory, Engeström (2002, 2016) points out that one of the problems of the first generation of theorists of historical-cultural psychology, represented by Vygotsky, was focusing on the analysis of activity in the individual dimension. This fact, according to the author, was overcome by Leontiev, considered the second generation of activity theorists, when he elucidated the difference between individual action and collective activity. Engeström expands the graphic model proposed by Vygotsky and conceives a model of an activity system that adds to actions thought at a micro level, that is, individual, collective dimensions, contemplating macro aspects of social life, highlighting how the activity is constituted as a "systemic whole" (ENGESTRÖM, 2016).

Figure 1 explains the structure of the activity system elaborated by Engeström (2016), and its upper part should be seen as "[...] 'the tip of the iceberg' representing individual actions nested within a system of collective activities" (ENGESTRÖM, 2002, p. 36). The lower part highlights the social sphere that permeates any activity. Based on this representation, Tomaz (2007) states that the analysis of activity in this theoretical framework includes six fundamental aspects: what the individual does; the objectives that mobilize their activities; the tools they use; the

community of which they are part; the rules that regulate their actions; and the division of labor of which the activity is a part.

Figure 1 – Activity system structure
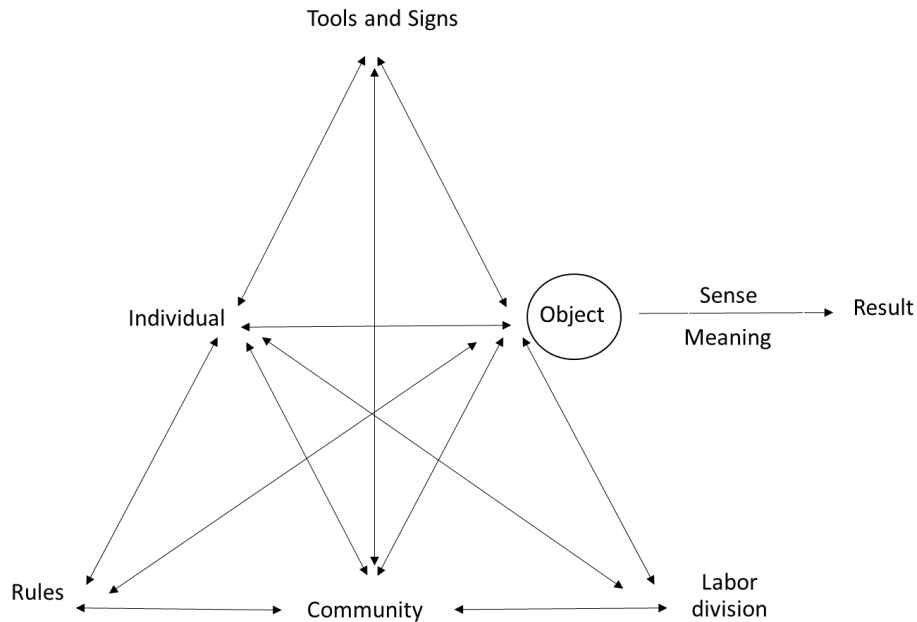
Source: Engeström (2016).

In the modeling presented in Figure 1, the upper part of the triangle contains the elements already idealized by Vygotsky. Therefore, according to Engeström and Sannino (2016), the subject pole can be filled by an individual or a group responsible for providing the perspective of analyzing the activity. It is important to highlight that one of the central objectives of Activity Theory deals with the expansion of this perspective and, as such, seeks to transpose the analysis of activity from the individual's point of view to the analysis from the collective point of view. From this perspective, the object of the activity is defined as a place of problems that directs the activity, characterized by its ability to connect individual action to collective activity (ENGESTRÖM; SANNINO, 2016).

Through the action of the individual or group on the object, mediated by tools and signs, the result occurs. According to Lima (2019, p. 150), "[...] in a system of collective activity, these results cease to be momentary and situated and become socially important results that create relatively lasting forms of interaction." Thus, the result of the activity thought collectively has social importance, going beyond the objective of the subject in an individual action.

Another important point in the theory developed by Engeström (2013, p. 70) concerns the understanding that "[...] object-oriented actions are always, explicitly or implicitly, characterized by ambiguities, surprises, interpretations, creation of meanings and potential for change." This understanding is symbolized in the Activity System (Figure 1) through the circle located at the object's pole. We can say, therefore, that Activity Theory recognizes the multiplicity of possible

actions within an activity system, making it impossible to delimit them, at least completely, in advance.

Regarding the dimensions that represent the influence of social aspects on/in the activity, there are rules, division of labor, and community. The first, according to Engeström and Sannino (2016), are specific regulations, norms, and conventions, established implicitly or explicitly, formally, or informally, and that guide actions within an activity system. These rules can be social, organizational, or interpersonal (ENGESTRÖM, 2016). These dimensions – social, organizational, and interpersonal – are also present when Engeström (2016) defines the forms of division of labor. These, according to Lima (2019, p. 155), are approached "[...] from the separation between conception and execution, which establishes a hierarchy of power at the social level; the horizontal division of tasks within an institution; and the division of tasks carried out at the micro level of work organization by the subject." Finally, the community is conceptualized by the author as a set of subjects or subgroups that share the same object.

We corroborate the statement by Tomaz (2007) when she states that the poles of the activity system encompass social and material resources that enable or restrict the subjects' capacity for action, that is, they mediate the relationship between subjects or collectives and the object in question. Therefore, in this article, the conception of the activity system by Engeström helps us to analyze the aspects that permeate the teaching work activity in Professional and Technological Education, as we will explain in the next topic.

It should be noted, however, that, expanding and further complexifying the approach proposed by Activity Theory, Engeström (2002, 2016) also proposes carrying out a social analysis of activity that considers different activity systems that share the same object and/or other poles. The author is also concerned with studying the development of consciousness through expansive learning cycles. However, considering the scope of this article, we will not address such aspects at this time.

THE TEACHING ACTIVITY SYSTEM IN VOCATIONAL AND TECHNOLOGICAL EDUCATION

Based on aspects arising from Activity Theory, we propose to analyze the work activity of teachers in the technical disciplines of Vocational and Technological Education (EPT), conceiving it as an activity system, according to the conception of Engeström (2013, 2016). The approximation of the daily work of teachers Carlos and Adriano, as well as the data obtained through interviews and bibliographic review on the subject, made it possible to design a general system of activity for EPT teachers, which brings together in its poles the elements teaching activity advisors, as explained in Figure 2.

Figure 2 – EPT teaching activity system
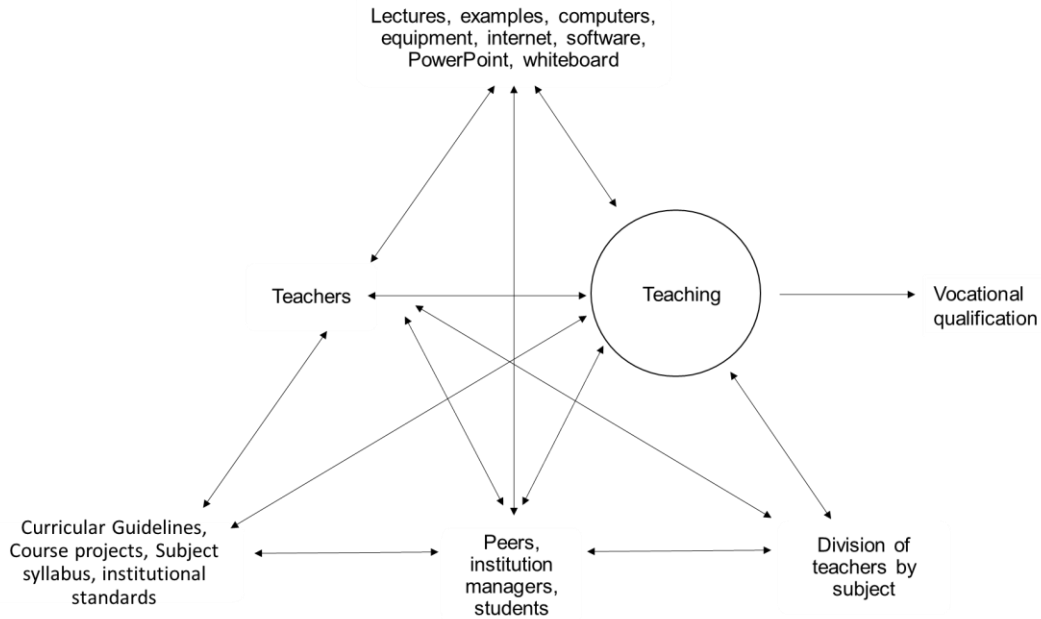
Source: Lima (2019).

In the activity system expressed in Figure 2, the subject pole is occupied by teachers, since our analysis starts from their point of view. The object of the activity is teaching, which is thought of based on the relationship between the subject and a social need and, is also, considered here as the primary reason for teaching activity. We highlight that, in our understanding, the student is constituted as a member of the community who shares the same general objective with the subject and who makes up another activity system in interaction with the teacher's activity system.

The result was defined by us based on the provisions of the legal texts that deal with EPTNM, especially the National Curricular Guidelines for Professional Education (BRASIL, 2012), also considering the discussions about the purposes of this form of teaching carried out by scholars in the field of EPT and the teachers' verbalizations about the objective of their work. Therefore, both legislation and studies on the purposes of EPTNM emphasize that it must provide its students with education aimed at vocational training and a comprehensive training – which covers the physical, intellectual, and moral dimensions –, enabling its critical role within society (GAMELEIRA; MOURA, 2018; RAMOS, 2019).

This direction of Vocational Education towards professional practice by teachers can be evidenced in Professor Adriano's speech as follows:

> *It's because when you're in the field [...] what I want to show them is that you must solve the problem, right? The problem cannot go away. The problem won't go away, right? It stays there. It's different here, but there's an owner there. So, you must solve the problem. If it doesn't work, you'll go out on the street. That's what I try to instill in them. You cannot abandon the problem* (Interview, Professor Adriano, speech 1).

In developing the teaching activity system, we concluded that the Tools/Signs pole, responsible for mediating teaching activity, is occupied by the different resources adopted by teachers during observations, as well as reported by them during interviews. These mediating artifacts are not static, varying according to the situation, the student(s), the content taught, the teacher, among others. Therefore, we noticed that the two teachers observed favored different artifacts to mediate the teaching-learning process.

We found that, in the theoretical classes taught by Professor Carlos regarding the Computer Network Design discipline, the teacher, during the explanations, creates drawings, and network diagrams and constantly uses examples on the application of content in computer resources. adopted by the institution itself.

> *I try to use CEFET examples because today it is the closest to the students. I see that creating fictitious, merely fictitious problems, I think is very difficult. They must have a very large abstraction [...] CEFET today, when I talk about services here, is the closest thing they have. So, from a wireless network, from a system that manages restaurants, from a library system, academic system. That's what... sometimes I even get a little worried about saying too much for security reasons, but I don't have any other example.* (Interview, Professor Carlos, speech 1).

This form of teaching adopted by Professor Carlos is made possible by his professional experience in the field of Computer Networks/Informatics within the institution. We clarify that this professor performed, at the time of data collection, an administrative role focused on managing information technology services at the institution. Thus, his professional experience outside of teaching, even within CEFET, enabled him to relate theory to professional practice.

> *But – I don't know if I said it – what helps me a lot is experience. The experience of having managed a network, of having seen how it works and so on. I even try to convey all of this to them: "Look, this was my experience."* (Interview, Professor Carlos, speech 2).

The influence of professional experience outside of teaching on the work of EPTNM teachers was also recorded by Pena (2016) as a key factor in preparing, organizing, and conducting the work of these teachers in the classroom. Therefore, according to the author,

> This type of knowledge was highlighted by all [the teachers] as relevant to provide the teacher with sources of examples, illustrations, and analogies that contribute to enriching classes and facilitating student learning, with the constant use of references to practical and real work, aiming to bring concrete situations of students' future professional practice to the classroom. (PENA, 2016, p. 86)

Furthermore, we showed that the choice of working instruments by teachers also includes a subjective dimension linked to the teachers' values. In the case of monitored teachers, the concept of Vocational Education related to future professional practice stands out, and, therefore, the definition of teaching tools is related to this training concern. Here we use an excerpt from the interview with Professor Carlos to demonstrate how the subject's values are present and

guide this aspect of his work. Firstly, when discussing the tools he adopts to teach practical content to students, the teacher states that

> *I try to avoid simulation because everything is done within the software. The controlled environment does not. You do that but on a much smaller scale. That's why sometimes I try to use a virtual machine. I don't know if you remember that I took the equipment. I try to do these things like this, to be as close to the real thing as possible* (Interview, Professor Carlos, speech 3).

However, the choice of tools is not disconnected from the reality of the classroom. In this sense, the teacher complements the information by indicating the consequences arising from his choice to make teaching "as close to real as possible".

> *As they had to get some tool and make it work, the errors there... they didn't... In each service, I had to debug a different error. And I tried to teach them: "Oh guys, the error is happening, right? So, how do we do it? First thing, look at the log, look at the event log. Let's read the messages. What is the business shouting?" Then I kind of tried to explain how to debug errors. Because making, installing, and making everything work nice and round.* **I can give** *a perfect practice. A practice he already copied the configuration. He just must press the button and do it.* **That would be easier.** *So, that's why that thing about the simulation and the real environment,* **I want to do it. It takes a little more work.** *Because, in addition to being the same error as it was and then you will see the causes and it is a typing error, a command that was not done, or that was done wrong. So, I'm also not crazy about giving practice without testing, you know? So, you do. In my case, it's: every error, every service you make there, is kind of like debugging an error. Sometimes it's not even clearing doubts.* (Interview, Professor Carlos, speech 4).

Professor Carlos highlights that there would be fewer problematic ways of teaching the required content, which would imply "easier" work for both the students and him, as the number of problems encountered by the students would be reduced. However, by seeking to establish proximity between teaching and real situations in the field of Computer Networks, the teacher opts for a teaching tool that would give greater freedom of action to the student, consequently increasing the number of possible errors to be "debugged" by the teacher – that is, causing an intensification of their work. Given this, we can state that the teacher's choice of tools and forms of teaching is not primarily guided by the "ease" or simplification of their work but involves a dimension of commitment to teaching and what they consider to be a good vocational educational.

Adriano, as he teaches a subject that needs to combine theory and practice, bases his classes on handouts, prepared by him or another teacher from the same department, as well as on resources found on the internet. We detected in this teacher's practice the attribution of great autonomy to students in the search for solutions to the proposed practical exercises. This aspect is explained by Professor Adriano as follows:

> *I learned – a long time ago – that students here at CEFET must be somewhat self-taught, otherwise [they] won't be able to win here. You must turn around. Here, if the student is not self-taught... That's*

why students here at CEFET are in high demand by the market. You give the student a problem, and he turns around and manages to fix it, he is proactive. (Interview, Professor Adriano, speech 2).

This appreciation and encouragement for students to solve problems autonomously are evident in the practice of Professor Adriano. We verified, during the observations, that the teacher explains the content of the day's practice but does not establish a routine aimed at controlling the activities carried out by the students. The teacher, after presenting the activity to be carried out, remains waiting for students to request assistance, individually or in small groups. Carrying out activities from other subjects or outside teaching, conversations between students, and movement in the classroom, aspects that normally demarcate some level of "disorder" and that can be seen as negative by some teachers, are not taken as problems in the classes by Professor Adriano. This characteristic, also present in Professor Carlos' classes, seems to be related to how practical classes in Vocational Education are organized and with this conception of an autonomous student.

It is important to highlight, however, that less concern with the disciplinary control of students does not equate to a lack of concern with the learning and engagement of these students. In this sense, during the observations, we showed that both teachers divide their attention between serving subgroups of students and the activities carried out by other subgroups more distant from them, sometimes interfering and warning that the students "aren't doing anything" or that are already late in terms of delivering some activity. This attention is guided by teaching experience, which is responsible for helping to develop knowledge/conceptions about the profile of each student, causing the teacher to pay greater attention to those who he believes "have difficulty" or who "are confused", as the interviewees reported.

At the same time, the analysis of teaching work activity made it possible to verify that there is an intrinsic relationship between the content to be taught and the teaching tools. Therefore, we demonstrate that the modernization of the resources/equipment/technology adopted in the concentration of the Vocational Network Course entails demands for updating the content and, consequently, the instruments adopted in the teaching-learning process.

According to Engeström (2016), the mediating artifacts of an activity system are related to the historical development of the community in which the activity system is inserted. In this sense, in the field of IT – constantly modified/modernized –, the mediating tools will change according to changes in the content to be taught and vice versa. Changes in the object, therefore, end up creating contradictions that lead to changes in the pole of mediating artifacts adopted in teaching practice. At the same time, the modernization of some instruments, such as software or equipment adopted in a class, implies changes and promotes disturbances in the object of teaching activity.

Given this, we can state that the technical requirements of the future work field (job market) sometimes come into contradiction with the content to be taught as well as the teaching tools adopted, and the teacher's conception of what students must know. This work of "managing" contradictions in practice, in turn, is done by the teacher himself.

Because I notice that, whether people here like it or not, the kids here learn a lot of Linux, a lot, a lot of Linux. Linux server and such, such, such. They learn very little Windows. So, when students leave here and go to work in a company that has Windows, especially Windows 7, they don't know how to work, because they didn't learn it here. And since I teach all servers, I don't teach all of them deeply. I'll just give it a go, if not, there won't be time [...] And it's important, whether you like it or not, because, okay, is Linux free? Yes! 90% of the market is Linux. That's fine, but there's also the guy who has to know Windows. (Interview, Professor Adriano, speech 3).

Firstly, it is necessary to mention two aspects that stand out in Adriano's verbalization: the first is that, in the case of teaching work in Computer Networks, the content to be taught, therefore, the object, coincides with the tool/instrument adopted for teaching. In this case, the Linux operating system, its functionalities, and the development of solutions based on it are what needs to be learned and, for this reason, it constitutes a primary teaching tool. The second aspect, which is not present in the teacher's speech, but which guides the content taught, is the possibility of access to tools, technical resources, operating systems, etc. In the example given, the predominance of teaching resources and tools based on the Linux operating system is due, above all, to their free access, as opposed to charging licenses for use by the Windows operating system – possibly, this same free access that makes most companies adopt such a system. Therefore, the choice of teaching tools/content in public Vocational Education entails a relationship with the job market, at the same time as it is delimited by the financial resources made available by the State and, also, by how these same resources are managed by the institution.

Given this verbalization by Professor Adriano, it is also possible to see that the professor articulates the content planned for teaching based on what he considers to be important for working in the job market but organized according to the available teaching time. In this context, we found that the reorganization of teaching work requires the teacher to establish the content that needs to be taught within a certain period (class, two months, academic year), considering the students' profiles, the material available, the teaching time, the progression of the subject to be taught, etc. In this sense, the aspects reported by teachers are in line with research by Tardif and Lessard (2011, p. 211) when they state that:

[...] teachers do not apply or follow school programs mechanically; on the contrary, they appropriate them and transform them depending on the situational needs they encounter, their previous experiences, as well as many other conditions, such as their understanding of the subject, their interpretation of the students' reality, the available resources, the progress of the class, their preferences, and values, etc.

The teacher's perception of what needs to be taught at each moment is based on the teachers' technical knowledge and their work experiences in the technical area, as we can see in the following statements.

But as I worked at DRI for a long time, we installed machines. Installed, configured, created users, had client infrastructure, client-server, and so on. So, a lot of it was practice. And the theory I had to learn. Then when I was given the discipline – so much so that the discipline I changed a little and it will undergo

another change. Because when I came here the discipline was purely practical. It was just a laboratory class. Then I thought that train was weird. I would get there and tell the student to format, and install, but without knowing what Linux is. (Interview, Professor Adriano, speech 4).

Today, I think practice [is important to be a teacher]. I'm not going to say that I have the biggest practice in the world. I have... I know people, professionals, who have much more practice than me. But what I always try — I even tell the students — I try to convey the whole experience, with cases [...] (Interview, Professor Carlos, speech 5).

It is important to highlight, at this point, the teacher's autonomy to make changes to the content, instrument, etc., resolving contradictions using their experience. In this sense, the teachers monitored declare that there is "freedom" in defining the content taught, the time allocated to each topic, and the forms and resources adopted for teaching and assessment.

On this subject, Professor Carlos points out some difficulties caused by the lack of definitions. Recalling his entry into teaching, the professor reports that:

I ran after that. There is no one who [says]: "Ow, come here and do it…". The person who helped me a lot was [Prof. X], but he's kind of... because he's the father of the course, right? So, he came to help me: "Ah, you're going to take the [network] project. You already work with this. You have know-how... I don't know what... You try to do that...". But when I took over the subject, I looked at it like this... The previous professor arrived and put it like this in the content: network design laboratory: Day 1: network simulation; Day 2: Network design. [...] He named the discipline himself! I took it... Oh, I don't know what he gave me. I said: "Oh [Prof. X], look at this, how do I do it?" [...] Then after the students arrived, I asked what they did...[...] I thought the following: I'm going to give it to them [says the name of a piece of content]. I know it is an important part of the course and at no point in the course did they see this. It is a matter of protocol that is seen. It's foreseen in the content anyway, but I know that... it was also something that, well, the guy is technical. He's going to mess with it. (Interview, Professor Carlos, speech 6).

The analysis of speech 6 by Professor Carlos highlights a problem regarding the autonomy in carrying out the course plan for each professor. In this case, the teacher who had recently joined the institution turned to his peers, apparently without success, to try to organize his task, but ended up defining the teaching content based on his knowledge about the students' future field of activity.

In the case described by Carlos, the "curricular openness" for teaching organization becomes problematic when, in addition to not knowing the work previously done by his colleague, the teacher did not go through situations that allowed him to build contextualized knowledge about the work environment. This lack of knowledge rooted in teaching work experience seems, however, to have been suppressed by knowledge coming from the trainees' area of professional practice, which predominated as a resource for organizing work by the teacher.

Returning to the teaching activity system and starting from the community proposition, presented by Engeström and Sannino (2016) as the set of individuals and subgroups that share the same general object, we define that it is made up of students, other teachers, and institutional leaders (coordination course, pedagogical coordination, institution management

bodies, etc.); that is, all those who care and act to guarantee education. However, analyzing the data collected, we found a "weak interaction" between the subject, his peers, and institutional managers. In this sense, when asked about the relationship between pedagogical coordination, course coordination, and other institutional management bodies, the teachers stated that there were sporadic contacts with the former, aimed at solving specific problems regarding the students, and no contact with other instances to discuss teaching activities.

Regarding work with peers, we also highlight the disarticulation of the work carried out by each person. Regarding this aspect, Professor Adriano characterizes the work at the institution as "islands" inhabited by teachers from each area. The professor also reports unsuccessful attempts to develop collective work.

> *I tried to talk to... In the computer fundamentals lab, I looked for [Prof. W]. He took and passed all the material to us. Then, me and [Prof. B] this discipline. I tried to talk to [Prof. B] to find out what she would give, what type of tool we could develop together, or something that she found interesting to pass on to me, something else that I found interesting to pass on to her, but... I asked She asked me to sign up for her course [on the AVA platform], and she signed me up. I enrolled her in my course, I put [Prof. A] too. But I couldn't tune in to her. She did her separate part and I finished... So, since she doesn't have that echo...* (Interview, Professor Adriano, speech 5).

This characteristic of Vocational Education teaching work, also addressed by Soares Júnior (2018), is present in several reports made by teachers. Such isolation, however, is seen somewhat naturally by Professor Carlos, who emphasizes the existence of this problem in other educational institutions, at the same time as he points out the problems of this isolation. According to the teacher:

> *Teachers generally don't talk. And that... In addition to having already seen this at [Institution Z], this was already discussed in our course. It's a reality like this: the teacher enters the classroom and that's it. Who's there? Are you going to the film class? You won't. Students are learning, so they have no real ability to evaluate what they have learned. Whether it was good or bad, we don't know. So... then you fall into something like this: what is the quality of the class? What is the quality of teaching that [you] are providing? You don't... It's anyone's guess.* (Interview, Professor Carlos, speech 7).

In his speech, Professor Carlos relates the absence of collectivity to problems regarding the possibility of developing a critical analysis by teachers regarding the teaching process carried out. It is important to highlight that a teacher's activity, even if carried out in isolation within the limits of the classroom, can interfere with the teaching work carried out by their peers since the weakened learning of some content by students makes the teacher need readjust their lesson plan. Based on Professor Carlos' statement, we understood that greater interaction between teachers would then contribute to the development of elements that would make it possible to rethink their practice.

Furthermore, we also understand that the activity systems of peers and managers understood as members of the community, will influence the constitution and changes in the teaching activity system. However, we found that the relationship between this community and

the subject, in the case of the work analyzed, occurs, most of the time, based on normative determinations made by institutional management bodies. In this way, the presence of the community in teaching work, except for students, concerns its influence in delimiting the professional performance of teachers, even if partially, by regulatory documents that establish the points to be covered in the discipline, their workload, class time, among other dimensions.

Regarding the division of labor within teaching in Vocational Education, we understand that it can, at first, be thought of from the social and organizational dimensions, as proposed by Engeström (2016), as an established form of work organization by the State and the educational institution. In this scope, the division of teaching work is related to the separation of the Integrated Vocational Course at the Secondary Level into subjects from the Common Basic Curriculum (Portuguese, Mathematics, History, etc.) and the Specific Curriculum; and these, between theoretical, practical, or theoretical-practical disciplines. In this context, laws and government resolutions establish the principles of the course's curricular organization, and institutions define its content and the appropriate forms of division of work, in which each teacher is considered responsible for teaching one or a set of subjects that make up the curriculum.

There is, however, a third dimension of the division of teaching work which is that made by the teacher considering external determinations, but also based on what he knows about his work environment, constructed during his experience, and each situation of work. Thus, the compartmentalization of teaching, the time for dealing with each subject, as we said, is established by the teacher based on his experience teaching a certain content.

> *You start teaching a discipline, then you think: "Wow, this isn't cool. The students don't understand that." What generates more questions gives you more time. This thing that you think is important, you see is not so important, you reduce time. So, you kind of improve like that. (Interview, Professor Carlos, speech 8).*

Given the above, we can see that the division of content by the teacher is rethought and changed according to the students' attitudes/responses in the teaching-learning process. This change can be made later, when planning subsequent classes or during the teaching situation. Regarding this aspect, during observation, we evidenced changes in the flow of theoretical and practical classes, in which the teacher interrupts the teaching of certain content or, in the case of laboratory classes, requests that students stop carrying out the practical exercise to provide explanations about topics that arise as common doubts among students.

We emphasize here that the teacher's experience appears as an essential element, since it allows the teacher to rethink teaching methods, considering not only the students' responses but also the determinations presented for their work. Regarding this topic, Professor Carlos explains that he organizes his theoretical classes by grouping students, trying to ensure that all their doubts are clarified.

> *The ideal is for everyone to do their own. But everyone must do their own thing... The risk is that everyone also has their problems. Same as this year, I have 17 students in this class. Resolving specific doubts from 17 students is very complicated. Because each case is different. Everyone did it in their way. Everyone*

made a mistake in their way. It's different from an exercise where one person's doubt is sometimes everyone's doubt. Not here. Each practice is... it ends up being unique, understand? (Interview, professor Carlos, speech 9).

The analysis of this excerpt allows us to see a contrast between the value of the teacher, related to his conception of ideal teaching, and the institutional norms that determine a specific time for each subject. This verbalization by Professor Carlos also allows us to highlight one of the predominant characteristics of practical subjects, therefore, taught in laboratories: the service of different groups of students, with specific doubts, in a short space of time. This aspect enhances the singularities of teaching work, requiring Vocational Education teachers to construct forms of teaching organization that make it possible to serve all students, individually or in small groups, within a short period.

Finally, we explicitly address the rules of teaching work activity in Vocational Education. They are the guiding documents prepared by the Federal Government or by the educational institution, and which deal with the content to be taught within a certain space and time, as well as the conduct of teachers with students, the uses of infrastructure, and institutional obligations.

We show, however, that there is a contradiction between the norms of/for work and the work activity. This fact is expressed, for example, when Professor Carlos talks about the demand, imposed by the course's pedagogical project, to develop a Course Integration Project (PIC) – called by teachers as Course Completion Work (TCC) – by students in the 3rd year.

It's a very big thing. They [the students] wouldn't know how to do that. There was no time. [...] They have no idea about anything. So, look at the project... If they have no idea about anything. To say that I'm going to do a real TCC like this, based on a project is... it must be at least in the second semester. Because they've already seen something. (Interview, Professor Carlos, speech 10).

Speech 10 by Professor Carlos initially relates the problems of carrying out the PIC to the lack of technical knowledge by the students. This fact, explains the teacher, is caused by the course's curricular organization, which prioritizes the offering of common core subjects during the first two years, concentrating subjects in the technical area in the 3rd year. Another limiting factor pointed out by the teacher is the time allocated for this task. In this sense, students would only have Professor Carlos' class period to concentrate on developing the proposed work, which brings problems to the quality of the work, according to the professor. Added to this is the lack of "availability" of students to dedicate themselves fully to the PIC, since they also need to carry out the activities required by other disciplines.

Then October, November arrived, I said [to one of the groups]: "Guys, what's up? Then nothing. Then they developed it, and I gave it a security approach. I don't know if you remember that group that invaded. They improperly captured data. It was a security approach. Then I said, "Let's develop this here, so you don't lose anything. You don't start anything new". Then in the course, they did it. It's something I have practice in, I'll be able to guide you. It won't waste time, let's do it." (Interview, Professor Carlos, speech 11).

In this excerpt from the interview, the teacher reports the disarticulation with the work of his peers, as one of the teachers responsible for monitoring the group of students had not done so in such a way that the students were able to develop the PIC. Professor Carlos even without any external request or requirement, began to assist the students in producing the PIC. To this end, given the short period until the end of the school year, the teacher proposed to the students that they base their PIC on a security tool, an area in which the teacher has extensive knowledge due to his professional experience in the information technology sector.

It is important to highlight that the teaching work activity is influenced by, but also influences, the configurations of standards established externally to them. Regarding this aspect, we can address Professor Adriano's speech when he deals with curricular changes in the Computer Networks course.

> *An example: is electronics. I say that I am against removing electronics from the computer science course because I think that when the student understands how semiconductor materials work, he has a better idea when he works with programming and such.* (Interview, Professor Adriano, speech 6).

During the interview, the teacher explains that the content of the electronics subject, even if it is not directly relevant to training in IT, provides a basis for students' understanding. This conception can be related to the teacher's training history, who is an Electronics Technician and Electrical Engineer. According to the professor, these courses provided the basic knowledge for his entry into the job market in the field of IT. Given this, we can infer that the perception of technical training by EPT teachers bears marks of their history of academic and professional training.

On the other hand, the teacher's perceptions, and ways of organizing work can influence the organization of the course, as we can see in statement 7 by Professor Adriano:

> *Then I started giving theories. Then the class got very boring because I gave three theories. Then I talked to people to do the following: so, let's give theory and practice. Instead of giving a theoretical class every week, I give a practical week a theoretical week, a practical week, and a theoretical week. That's when people started doing this. (Interview, Professor Adriano, speech 7).*

In the situation described by the professor, we can see that the professor's work experience, his perception of the organization, and the student's response provided elements to carry out a restructuring of the Computer Networks course. Given this, we find that the teacher's activity is not only determined by external elements but these are remodeled depending on the experiences of the person who works.

CONCLUSION

In this article, we proposed to carry out an analysis of teaching work activity in Vocational and Technological Education, based on the principles elaborated by the Activity

Theory from a historical-cultural perspective. To this end, firstly, we briefly review the assumptions for developing this Theory and present its current configuration, as established in the works of Engeström (2002, 2013, 2016). Subsequently, based on Activity Theory, we analyzed the work of two teachers from a high school vocatioanl course, aiming to fill in the poles of the activity system, as well as demonstrating how such dimensions are present in the teaching work of EPT.

Through this analysis, it was possible to demonstrate that the experience of each of the teachers is responsible for establishing how each of the poles of the activity system will be completed. Here, professional experiences inside and outside teaching come into play and mark the way each subject structures and conducts their work activity. At the same time, the use of teachers' experience makes it clear that the dimensions that permeate the teachers' work go beyond the possibility of delimiting the poles of the activity. There is, then, a unique perspective in this work activity that must always be considered in work analyses.

Given this situation, we can say that experience constitutes a source for modifying teachers' practice. As explained, these may be recent work experiences, but also constructed throughout the teaching and work career in the course's training sector. These experiences embody in the subject the knowledge of the historical, the collective, and the unknown by theory, which will guide the teacher's work activity in the here and now.

Also, we demonstrate that teaching work is also permeated by decisions guided by the values of each teacher. This fact can be evidenced, for example, when Professor Carlos (speech 4) talks about the way he organizes his classes. This subjective dimension linked to the subjects' values also helps us understand the choices made, which will result in the fulfillment of each of the poles, in addition to having consequences for the work of each teacher.

From the systematization of teaching activity, we also verified that the teacher's work does not occur in isolation, it brings together important social influences. In this sense, we can talk about the norms, the forms of division of labor, and interaction with students, which place limitations on the teacher's work.

Given the above, this situated treatment allows us to fill in the poles of activity based on common aspects that mark the work activity of EPTNM teachers. At the same time, when we base our analysis on the teachers' point of view, we see that the work of these teachers involves a series of other spheres that go beyond any possibility of prior delimitation. Furthermore, it is important to emphasize that the teaching activity system is always in relation to other systems, whether those of the State, which establishes the standards for work; in the students, who, through their engagement or not, guide the way teachers work is organized; and in the job market, which will influence the content and tools to be covered in the vocational training offered by educational institutions of the Federal Network of Vocational, Scientific and Technological Education.

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The authors declare that there is no conflict of interest with this article.

DECLARATION OF APPROVAL BY THE ETHICS COMMITTEE

We declare that this research was approved by the Research Ethics Committee (COEP-*Comitê de Ética em Pesquisa*) through opinion number 2.132.0338 and registered under number 68631717.0.0000.5149.