



THE PROFESSIONAL DIDACTICS (PD) AND DIDACTICS OF SCIENCES (DS) IN BRAZIL: SOME IMPLICATIONS FOR THE PROFESSIONALIZATION OF THE SCIENCE TEACHER

Francisco Regis Vieira Alves

Abstract: The Professional Didactics (PD) and Didactics of Sciences (DC) have roots traditionally originated in France. While (PD) is interested in the process of adult learning, occurring in their work places, the (DC) shows greater attention to the field of action of teaching and learning of specific subjects and therefore in the action of the teacher in the classroom. On the other hand, in Brazil, we observe the development of research involving a perspective of complementarity, in view of the initial and continuous training of teachers working in Science and Mathematics teaching. Thus, the present work addresses some representative elements of (PD) that have an immediate field of application, in order to provide an understanding of the role and work developed by the teacher, in the teaching of disciplines, as well as the analysis of other related components, for example, with the notion of professional competence. In the end, the work accentuates the use of technology to provide an understanding of the notions discussed, with help in visualization, such as the use of GeoGebra software.

Key words: Professional Didactics, Initial training of Teachers, Teaching, Competence.

1. Introduction

In Brazil, the problems related to the field of the formation of science teachers have historical characteristics, according to their origin and, mainly, according to their own nature, which present obstacles that are difficult to overcome. On the other hand, in spite of the necessary recognition of the contribution of research in the field of Didactics of Sciences and Mathematics (Astolfi, 1990, 1993; Bas, 2005; Joshua & Dupin, 1993), in order to overcome these obstacles, a disregarded dimension lies precisely in the character of professional competence and efficiency in the proper execution of tasks, in the work environment.

In fact, in Brazil we have identified certain references for the formation of teachers in the teaching of Sciences, conditioned by intrinsically epistemic elements. In many cases, when we take as reference the continuous formation of teachers, we observe the need to return to the original academic training environment, prepared and structured by a disciplinary perspective that, in a way, is distanced and unrelated to real problems from the school or, much less, from the actual functioning of the classroom.

On the other hand, a restricted point of view is one that seeks to interpret the action or activity of the science teacher, taking as reference only the conditioned elements of the disciplined knowledge mediated, necessary for his teaching. Thus, another perspective of appreciation involves considering the process of learning in and of work, that is, the acquisition process and the evolution of the teacher's abilities that must irremediably constitute gradually their professional competence.

Thus, we emphasize the recent research developed in Brazil, around the use of Professional Didactics (PD). The Professional Didactics (PD), whose origin can be observed in the nineties, in France, constitutes a field of studies derived, initially, from the formation of adults, with the confluence of three branches of studies, namely: The French Psychology of work, Ergonomics and Didactics.

Professional Didactics provides a complementary and necessary point of view, since all the activities and tasks developed by the science teacher can not be glimpsed in a fractional or separate way. Thus,

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when we talk about professional competence, we have to consider the spectrum of the skills employed by the teacher, both within the classroom, as well as in the working environment, that is, in the school environment (Alves, 2016).

In addition, we identified in (PD) a marked concern with the relationships between training and work situations, as a structuring point of this field. That is the analysis of work, aiming at the training of professionals and, in particular, the training of teachers, also involves an analysis of the conception of training, and the necessary reflection on work and adult learning. In this context, in the present work, we will discuss some fundamental notions for Professional Didactics (PD), arising from a perspective of application to the field of teacher training that teach certain specific subjects (Mathematics, Physics, Chemistry and Biology). Thus, we will try to identify and describe certain notions that allow an advance to the field of teacher education in Brazil. In addition, in spite of the academic reference frameworks adopted in our country, we indicate that certain anachronistic conceptions must be replaced and, unquestionably, the Professional Didactics presents a differentiated scenario, in the sense of impelling the necessary changes in this our academic work.

In the following section, we will approach some elements, however, respecting the limits imposed by this article, we will add those that seem to constitute a greater repercussion for a conception of formation, professional development from the PD's perspective.

2. The Professional Didactics (PD): some assumptions

The Professional Didactics (PD), originated in France in the nineties, is formed by the confluence of three fields of study (Mayen, 2007; 2012; Mayen & Olry, 2012; Olry, 2012; Parmentier, 2008; Pastré, 2011; Savoyant, 1996; 1981; Veillard, 2012; Yvon & Garon, 2006). The Psychology of Work according to the French language, Cognitive Ergonomics and Didactics, with a strong emphasis on Developmental Psychology. Pastré, Mayen & Vergnaud (2006, p. 145) demarcate three orientations assumed, as a matter of priority for the (PD). The first orientation refers to the fact that the analysis of learning can not be separated from the analysis of the activity of the actors themselves. In fact, if we take a development perspective seriously, it is necessary to recognize the irreducible character between acting and learning in situations of activity. The second orientation is based on the fact that it is necessary to analyze vocational training, or the formation of professional competences, it is necessary to observe them not only in schools, but also in an extended way in the context of work itself. Finally, the third orientation, according to the authors, involves the necessary understanding of the articulation of activity and learning in a context of professional performance and your progress in time. In the figure 1, we take the translation: *ingénierie sociale*=social engineering, *ingénierie de formation*= engineering for professionalisation, *ingénierie pédagogique*= educational engineering. Moreover, we see the *lignes des enjeux*= lines of issues, *ligne des usagers*=line of users, *ligne des institutions*= line of institutions.

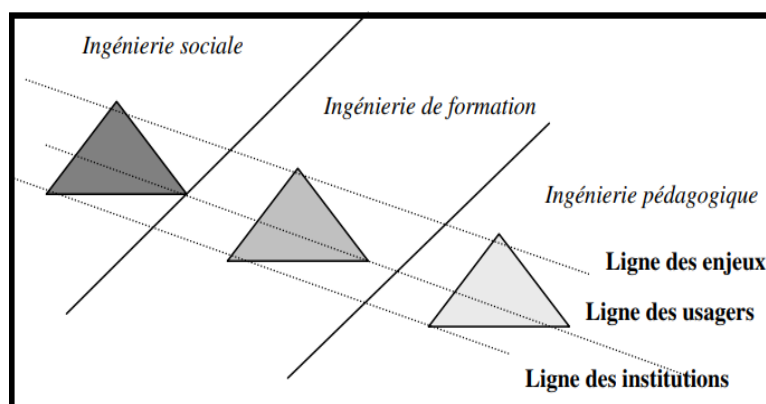


Figure 1. Leclercq (2002, p. 80) discusses and distinguishes three complementary notions of engineering (*ingénierie sociale*, *ingénierie de formation*, *ingénierie pédagogique*).

Pastré, Mayen & Vergnaud (2006, p. 145) explain that, for a number of its creators, “the Professional Didactics was born from the context and the extension of adult education. One of the forms that appeared at this moment that can be considered with the most characteristic of the continuous professional formation is the engineering of formation”. Here, we should point out that in France, at the end of the sixties, the use and discussion of social engineering, engineering of professionalization and pedagogical engineering became recurrent. In this way, “the notion of application and use of engineering in a field of professional training has become frequent” (Leclerc, 2002, p.76). In figure 1, Leclercq (2002, p.80) indicates the notion of professionalization engineering that derived strong impregnation with several fundamentals of PD. Throughout the text we will translate the term in French indicated by *ingénierie de formation* - engineering of professionalization.

Pastré, Mayen & Vergnaud (2006, p. 145) explain that “Professional Didactics is interested in a field of practice that consists of building training and modeling devices that correspond to the needs given to a certain public, considering in a workplace”. In addition, they observe that the school formation has a marked characteristic in decontextualizing of the learning process. On the other hand, engineering of professionalization will insist on the contrary, that is, in the contextualization where adult learning occurs, above all, in the course of their work activities. Below, we understand the authors' point of view on the applied notion of engineering of professionalization. In fact, Pastré, Mayen & Vergnaud (2006) that:

Engineering of professionalization is concretized mainly by two practices: analysis of the needs and construction of adult training devices. It is precisely the analysis of work and needs that serves as input for professional didactics. It is a practice that seeks to deal, together, with the needs, usually translated in terms of objectives, the demands of the actors and the demands of the companies. It is, therefore, a deepening of the process of analysis of the needs that comes to the analysis of the work.

(Pastré, Mayen & Vergnaud, 2006, p. 147).

One of the convictions observed within the professional didactics is revealed by the problem of the debate about professional competences. For example, it is not possible to reduce the field of discussion, around the binomial qualification - competences. In fact, Pastré (2001, p. 1) has the conviction that “if we want to understand the problem of professional competences, it is necessary to analyze the problem of their development from a didactic point of view”. On the other hand, we can not disregard a representative characteristic in France, since the creation, throughout the country, of university institutes of teacher training (*Institute Universitaire de Formation de Maître – IUFM*), which involved the grouping of various professionals of several theoretical orientations. In the case of professional didactics, we remind psychologists, ergonomics experts and specialists in work psychology and general didactics.

Thus, after the creation of the IUFM, Pastré (2001, p. 1) recalls a tradition of about thirty years in the context of the history of work in France and, as in the case of studies in Science and Mathematics teaching, we observe a movement of similar research. In this context, Pastré (2001) described the interest in professionalisation engineering in the late of the sixties and early of the seventies.

When the professional formation began to develop and to reflect on its objects, its reflection has essentially emphasized to what we denominate of engineering of professionalization. Pastré (2001, p. 2) realizes that it is an important theoretical invention directed to continuous formation, and constituted by means of diverse practices. It is the right time to reflect on the analysis of professional needs and analysis of the demand for continuing training. It is the moment still of the construction of devices corresponding to a social demand and that marks the difference between the initial formation.

Another element pointed out by Pastré (2001) refers to the emergence of pedagogy of objectives or pedagogy by objectives. Its introduction marks a major change, involving the need to build training contents based on the analysis of professional activity. One of the main limits, at that time, lay in the behaviorist conception linked to the notions of analysis of professional competences. A common thought, therefore, was constituted by the simplistic notion that being competent was constituted in knowing how to execute or dominate a certain form of work organization, of the Taylorian type.

Pastré (2004, p.215) points out that, during the period of the crisis of work organization, in the Taylorian perspective, the notion of competence progressively increased its own meaning, given a scenario of increasing complexity of the processes required in the field of work (Savoyant, 1974, p.239). In the face of a movement of change, "other unusual forms of work place the operators before the task of problem solving" (Pastré, 2004, 215). There was a gradual shifting focus from the individual to the collective at work, with substantial concern with the fundamental processes of information transmission and group organization (Savoyant, 1974, p. 221). Below, Pastré (2004) indicates the changes around the conceptions of work analysis, and above all, the emphasis on solving problems arising from some essential activities.

In summary, we can see an evolution of the notion regarding work transformations: there is less emphasis on applying the procedures and more on the intelligence involved in the task and solving problems with multiple dimensions. [...]. Because to improve the professionalism of these actors, it is necessary to be able to analyze how their action is organized, what knowledge, what strategies they mobilize, what obstacles they involve. In short, we must be capable of a cognitive analysis of mobilized skills and their development. (Pastré, 2004 p. 214).

For a long time, cognitive development was discussed as defining for understanding the evolution of children. On the other hand, according to an eminently historical and social understanding, the similar process in which children encounter problems and, in view of the need to adapt to them, define and elaborate their evolutionary course, a similar thought can be envisaged in the field of adults. In fact, "we can observe episodes in the field of adults, over the course of their life, around the confrontation with problems that they experience in their field of work" (Pastré, 2011, p.85). Thus, professionalization does not constitute a process independent of the cognitive development of the adult and, with the interest of understanding the phenomena in question, PD is, from the functional point of view, a kind of "Pedagogy of professional situations" (Pastré, Mayen, Vergnaud, 2006, p.186).

We also emphasize that the understanding of the notion of professional competence plays an essential and prominent role within the DP. In fact, Leplat (2008, p. 143) explains that "the notion of competence lies in several different disciplines and, in particular, those with a specialization in work, such as Work Psychology and Sociology of Work organizations". In the course of this article, we will restrict ourselves to its cognitive character, to the detriment of the sociological bias of the discussion of the notion of competence. Thus, Leplat (2008) recalls that the view of Ergonomic Psychology is useful, since it develops an appreciation of the notion of competence and assumes the idea that each representation leads to a necessary analysis for the activity. Leplat (2008: 144) explains that "to say that an individual has competences related to the execution of a task involves saying that he knows how to execute without the need to mention or explain the corresponding procedure of execution".

In the previous context, we can not disregard the fact that the notion of task (*tâche*) indicates what should be done and the activity (*activité*) refers to the set of actions objectively realized. "The notion of task conveys the idea of prescription, and obligation. The notion of activity (*activité*) evidences what must be mobilized by the subject in order to execute the prescriptions". (Leplat & Hoc 1983, p. 51). On the other hand, the goal (*le but*) is constituted as something that must be accomplished and the final state yielded, according to the execution of the activity.

The objective (*le but*), according to Leplat & Hoc (1983), must also observe the following conditions: the intermediate stages that must be traversed, aiming to reach the final state, constituted as the objective; the permissible operations in order to provide the evolution of the intermediate states; the procedures to be used for this purpose and the specialized and hierarchical combination of such operations.

Leplat (2004: 101) stresses that "the analysis of work has evolved, not only because of the changes in work but also because of the enrichment of the knowledge and methods to which it appeals." Leplat (2004) observes the historical evolutionary context in France that contributed to the development of the psychological analysis of work that, in the previous historical period, encountered a strongly Taylorian thought.

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A distinctive feature of (PD) is, in particular, the identification and recognition of possible obstacles by performing fundamental tasks in certain activities at work, as we see below:

We can see that, in good situations, the confusion of the spirit, the manifestation of incompetence, the errors and the approximate practices or the obstacles to learning, do not have great things to reveal as far as people's knowledge and skills are concerned, but they reveal, very well, other factors that constitute the professional situations, in other words, that constitute the own conditions of the work. Initial or continuing training may, however, in no way prevent such obstacles. (Mayen, 2012, p.62).

Mayen (2012) warned, in this passage, an inseparable element of discussion, also, in the scope of teaching of Science. In fact, above Mayen (2012) refers to certain misunderstandings of the subject, intrinsically conditioned and nuanced by the conditions and constituent elements of a professional situation. For the purpose of better understanding and explanation, we can consider, as reference, the experienced professional and the novice professional, whether he is a teacher or not. In this case, we observe that the repertoire or spectrum of skills and abilities to deal with complex situations, and especially those whose nature turns out to be unexpected and erratic, are, in fact, the main and most important challenges that arise from the activity of the professional (teacher).

In addition, in face of labor demands, the broad treatment and mastery of relevant variables involved, of the newly admitted in the profession, will be required as soon as possible. Consequently, in spite of the intrinsic nature of work, as Mayen (2012, p. 62) stresses, as a conditioned activity, an imposed social situation, arising from demands and conditions imposed. Here, we see similarity, for example, with school situations that, respecting the specificities of each one, can also be observed certain obstacles indicated in the teaching of Sciences, confirming the constant requirement of its overcoming, as an expected indicative of learning.

In any case, professionals in general, whether they are teachers or not, acquire and develop much of their learning in the professional environment, in a tacit and pragmatic way, recurrently appeal to certain immediate and pragmatic judgments with the purpose of making their choices and judgments of work and teaching situations. In fact, Fischbein (1987) notes that:

Professionals, people with rich experience in a particular domain, develop particular intuitions related to their field of activity. Physicians, teachers, engineers, etc. are able to make decisions in their domains only on the basis of a seemingly minimal amount of information that they are able to use with insight. The expert can select the information obtained in order to capture the most relevant aspects of the process and determine its significance, despite the probability of several possible interpretations in the given circumstances, and organize the whole into a highly plausible conclusion. What is fundamentally important is that the expert has the ability to translate relevant messages seemingly into obscure and non-salient aspects of the situation. All of this can be done automatically before any systematic and thorough analysis is done and seems to be an intuitive and globalizing assessment. (Fischbein, 1987, p. 60)

In the above quotation, we need to emphasize the irreplaceable role of pragmatic concepts, which function in an essential way, to provide judgment and diagnosis of professional situations. On the other hand, (PD) expresses special attention to the functioning of pragmatic judgments and concepts, due to the process of regulating the activity and action of the teacher or any professional.

Pastré (2002, p.12) explains that pragmatic concepts serve mainly to make a diagnosis of professional situations, in view of the efficiency and the fulfillment of defined objectives and goals. What is seen,

in this condition, is not revealed by the epistemic or formal component of scientific and technical knowledge, but by its pragmatic bias. Pastré (2002: 13) explains that "a diagnosis of a situation can not be satisfied with the approximation and globalization. It is necessary to select what is presented in the situation as really relevant." In this scenario, therefore, the distinction between novices (apprentices) and experienced professionals will be the distinguishing feature. Experienced professionals extract little and necessary information about the situation and very often stick to certain details that may be relativized and / or neglected by the novice trainee.

Pastré (2002, p.12) observes that "the pragmatic view is then translated by a semantic dimension. It is a question of constructing relations of signification between indicators and functional variables in order to make a diagnosis of the situation". Distinct from the notion of everyday concepts, viewed by Vygostki, DP is interested in pragmatic concepts objectified in work situations and, primarily, derived from a characteristic activity. In fact, we will now see its explanation and distinction.

Pragmatic concepts have a dual status: they represent objects of change within the framework of the knowledge of the profession and belong to the prescriptive field, in an extended sense. They are transmitted from the older to the younger, through a mixture of verbalization and demonstration, similar to the everyday concepts of Vygostki. However, the transmission is not enough to truly possess a concept. It is also necessary that the pragmatic concepts be object of construction by the subject. We can say that what is transmitted is a representation and that such representation does not become a concept in the condition to the constructive activity of the subject. (Pastré, 2002, p.13)

Professional Didactics (PD) records the differences with Didactics for the teaching of disciplines that are in the second case, structured around the transmission and acquisition of knowledge. Professional Didactics focuses on learning activities (tasks). Professional Didactics may still qualify for the interest in adult development, coupled with the strong idea that adults find their development at work. (Pastré, 2011, 84).

3. The Didactic of Sciences and Mathematics

In the previous section we discuss some aspects about Professional Didactics – (PD). Certainly, given the limits of our current work, we do not intend to detail all possible aspects of this branch of research, but above all, some elements that should allow us a perspective of immediate application and implication for the teaching of Sciences and, moreover, a descriptive view of the role of the teacher and the necessary and indispensable notion of professional competence.

With regard to the field of research on teaching and learning of specific subjects, it is important to remember a recognized academic tradition of french origin as well. Thus, in a contemporary way and independent of the research around (PD), the didactics of Sciences acquired a first space of discussion in the field of Mathematics teaching and Physics teaching. In a pioneering way, we look at the studies of Mathematics Didactics and, specifically, in physics teaching, we underline the pioneering notions introduced by Bachelard (1934), with a strong emphasis on the disciplinary epistemic field.

Next, we present a reflection by Joshua & Dupin (1993) on the incompatible and unnatural character of the ideas of common sense that, in general, find a scenario of constraints and obstacles, from a comparative paradigm of inexorable establishment of formal scientific notions.

The researches in Science and Mathematics Didactics have shown broadly in recent years that certain answers produced by students in the face of scientific problems may be strongly linked to the corresponding canonical models. The scientific model is not often seen as an extension of common sense. Such a solution of continuity immediately indicates a greater difficulty, which is further accentuated by the fact that it is often the concepts and modes of reasoning linked to common sense that prove to be much more deeply rooted than those produced by scientific teaching and , still of prolonged duration. (Johsua & Dupin 1993, p. 121).

The Didactics of the Sciences – (DS) provides an understanding of phenomena intrinsically linked and derived from the interactions between the elements of the classic trinomial indicated by students -

teacher - scientific knowledge. On the other hand, certain characteristic paradigms of a general didactics, marked by presuppositions that do not present any adherence, proximity or explanatory capacity of any phenomena originally conditioned by different disciplinary fields. For this reason, there have been episodes of contextualization, substitution and the abandonment of perspectives incapable of explaining didactic transposition (Chevallard, 1991) processes, eminently originated and referenced by certain scientific knowledge. Below, we observe this concern in the training context of students in initial formation, aiming at the professionalisation of teacher.

Teacher training aims to acquire the professional skills to enable the teacher to cope with unexpected situations. Presented as a useful tool for prediction and regulation, Didactics can actually facilitate management of teaching situations. Therefore, the *corpus* of Didactic research developed in the field of teaching was originally a material of choice for teachers. [...] However, the introduction of epistemological and didactic concepts in training situations can help the teacher to orient his practice to the conditions of adequacy and the adjustment between conceptions and practice becomes a training objective. (Schneeberger, 2001, p.41)

In fact, the area of study of didactics of science and didactics directed to vocational training have a character of complementarity, since in the work environment and the activity, not all relationships are conditioned by disciplinar and classical knowledge. In this way, Baudouin (1999) observes that:

In fact, the Didactics orientation of the disciplines traditionally affirms the central role that the contents of knowledge assume and the brand they imprint to the learning processes and teaching practices that concern them. The focus of the development of the subjects is located before the confrontation in relation to the constituted knowledge. On the other hand, in the field defined by the research in Didactics of Formation, the reference is not so much about knowledge as about activity, as the researches developed on the work allow us to understand. (Baudouin, 1999, p. 152).

In the figure below, in order to provide the reader with the proper distinction and generalization of the interest of (PD), we see on the left side the classic didactic triangle that indicates, in its vertices, the main elements considered in the (DM), namely: teacher (of mathematics) (*professeur*), student (*élève*), knowledge (*savoir*). On the other hand, in the same figure, on the right side, Baudouin (1999), presents a three-dimensional figure with the opportunity to explain the interest of research on vocational training. In its vertices, we observe: activity (*activité*), learner (*apprenant*), knowledged (*savoir*), master (*formateur*). Baudouin (1999, p.151) warns that the logic of models of scientific knowledge is not sufficient to explain the rationalities proper and particularly applied in the medium of use of professional activities.

Therefore, "the logic of the classic didactic triangle - knowledge / apprentice / trainer - is not enough to characterize the learning situations proper to adult education," according to (PD). In any case, on the left side, we see a point of view irremediably conditioned by the epistemic field of scientific and classical knowledge, while on the right side we consider a field of idiosyncrasies and pragmatic peculiarities originating from work.

In the figure 2, in the right side, of consider the terms: *activité*= activity, *apprenant*=learner, *formateur*=trainer, *savoir*=knowledged. This little legend can help us to understanding some particular terms in french.

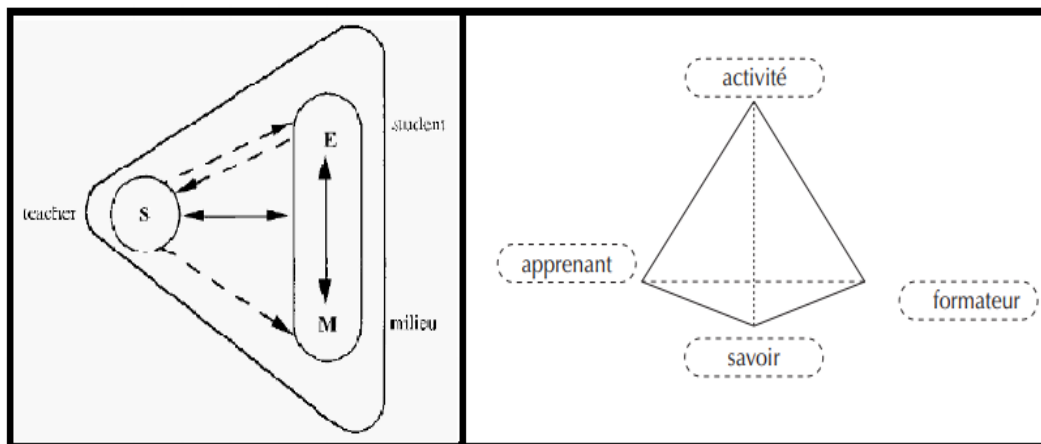


Figure 2. On the left side is the classic epistemic triangle of the Didactics of Mathematics and, on the right side, the descriptive tetrahedron for the professional formation proposed by Baudoin (1999).

On the other hand, despite the great effort and systematic investment aiming at the construction of scientific knowledge capable of supporting the action of the teacher, we nevertheless find a great distance or gap between the scientific knowledge, originated in the field of Science Didactics, in a recurring fashion, circulate only through magazines or periodicals of specialized information and do not reach the classroom. In this sense, Schneeberger & Triquet (2001) question that:

The teacher trainers, more and more, use their research work in Science Didactics, even referring to papers published in specialized journals, or even with reference to their own contribution of their research in the field. Preliminarily, dedicated to the use of researchers, certain concepts of Science Didactics are, thus, teaching in the frames of teacher training. (Schneeberger & Triquet, 2001, p.5)

Astolfi & Peterfalvi (1997) discuss, for example, the research developed in the field of Science Didactics, whose main interest was devoted to the understanding of epistemological obstacles. The preliminary notion of obstacles, according to the Bachelard perspective, presents itself as an invisible difficulty, concerning the subject engaged in an investigative activity. The perception of a difficulty, resistance and lethargy of the progress of the mobilized knowledge are the indications of its manifestation, or residual mark of its influence on the subject. Astolfi & Peterfalvi (1997, p. 194) pioneered the term "obstacle work", thus suggesting a similar understanding of its occurrence in the field of work performance definition teacher. Consequently, while in the course of Science Didactics studies, we have seen the development of didactic devices in order to understand the logic of the evolution of study learning in the face of the notion of obstacles. Similarly, we advocate the development of didactic devices capable of "mapping", predicting its occurrence, to the course of the necessary learning throughout the teacher's professionalization, for example, in his initial formation.

4. The Professional Didactics (PD) applying in Brazil

In the researches developed in Brazil, we have developed a perspective of complementarity, observing that the role of the teacher in the teaching of Sciences can not remain as explanatory vies, only by the relations conditioned by the disciplinary epistemic field. In our perspective, when we perceive the teacher as a professional, as a worker who works in disciplinary education and within a formal teaching institution, we need to understand a hierarchical system of his obligations, activities, planning and particular ways of acting, in order to belong to a group of professionals, and appropriates a set of routines characteristic of his profession.

We apply some notions and distinctions from the (PD) to the context of teacher training in Science and Mathematics in Brazil, in the academic context. In fact from the french context, we distinguish the different meanings of the terms: task (*tâche*), job (*poste*) and profession (*profession*). According to the ergonomic studies, the activity (*activité*) is constituted as the work to the course of its accomplishment

and duration, accompanied by its execution and the evolution of mental representations corresponding to the development of an activity or task. But the task (*tâche*) is "a set of prescribed goals and procedures, given the required performances and expected quality" (Tourmen, 2007, p 516). On the other hand, certain tasks or work functions are defined and demarcated by the hierarchical institutional structure of the school itself, and "some individuals are recruited according to their competencies and qualifications" (Tourmen, 2007, p. 517). Thus, the notion of post (*poste*) of work has a defined and essential function, according to the organizational interests of the work.

Let us now look at the notion of *métier* that distinguishes itself from the notion of professional, according to the French language. In fact, Tourmen (2007) comments that the notion of *métier* that "appears more complex than it seems at first sight" and, despite its current use, there is a confused understanding about it. Some authors of the current of work define the profession as certain forms of historical and social organization. Thus, we can discern four fundamental elements: professional organization, identity, work evolution and set of specific knowledge.

Thus, the *métier* originates, "when observing people from the same domain, who come together, to negotiate the definition of the role, the tasks, the knowledge of the practice, the knowledge to the own post must develop, with the objective of abandoning the undifferentiated polyvalence" (Tourmen, 2007, p. 518). Tourmen (2007, p. 519) clarifies a basic principle for the identification of the *métier*, since "once the actors occupy certain jobs and regroup to define and defend, debate and stabilize the knowledge of the specific *savoir-faire*, claiming a specific progression or identity, we can speak of *métier*". Thus, when we talk about *métier*, we consider a sense of stabilization and demarcation of the field of professional activities.

In figure 3, we present a dynamic construction of the Geogebra software that allows the visualization of the relations originated from the elements of the epistemic triangle glimpsed in the context of action in the plan of the task (*tâche*) implemented by the teacher. In the figure 3, we still consider *savoir*=knowledged, *professeur*=teacher, *compétence*=competence, *transposition*=transposition, *obstacle*=barrier, *élève*=pupil.

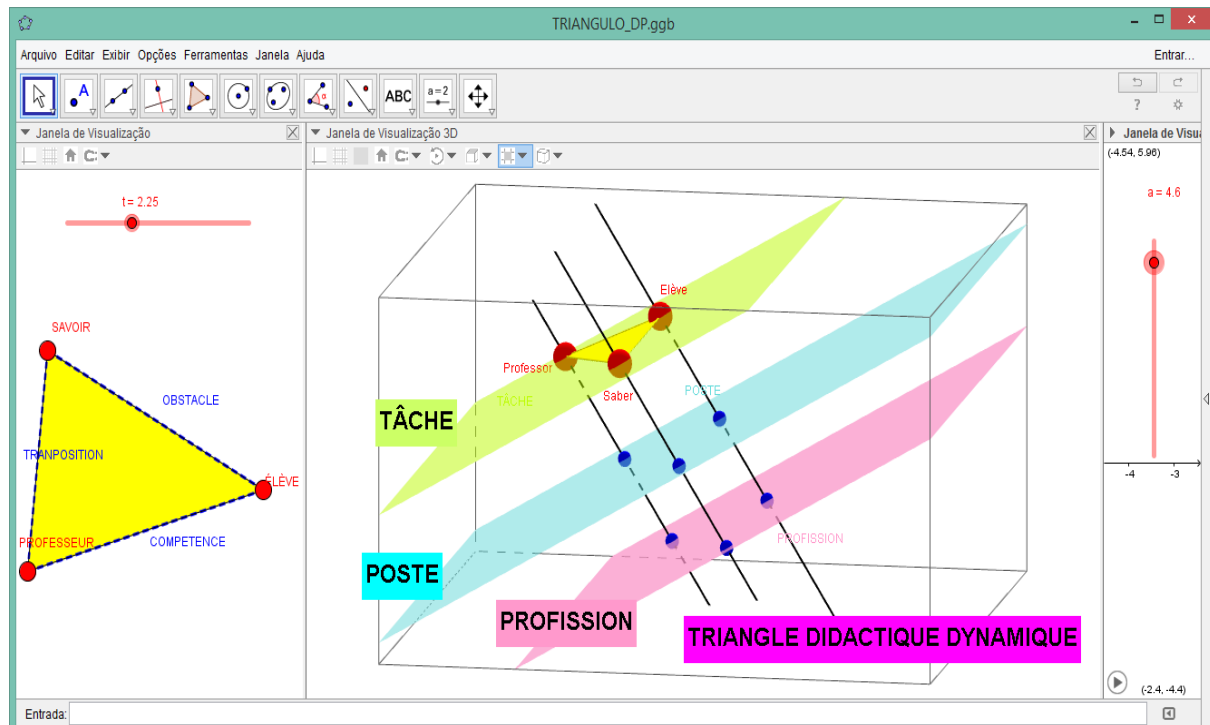


Figure 3. Visualization of the epistemic dynamic triangle of Didactics of Sciences defined in the field of the teacher's tasks. (Prepared by the author)

In figure 3, we present a dynamic construction of the software GeoGebra that allows the visualization of the relations originated from the elements of the epistemic triangle glimpsed in the context of action

in the plan of the job (*poste*) implemented by the teacher. Finally, we come to the term "professional". Tourmen (2007) points out "an american sociological approach to the professions, originated in 1940 and linked to the american legislation distinguishes professional organization and association and establishes the distinction between the terms profession and *métier* (occupation)." Thus, it is necessary that "the profession be socially necessary, and its members follow a deontological code, respected by the group". (Tourmen, 2007, p. 519).

Differently from the plane of the tasks, when in the plan of the *poste*, we observe, in a more expressive way, a greater mobilization of pragmatic concepts, considering that, in the plan of the *poste*, we see a set of established relations of the teacher with his colleagues, in the execution of similar and discriminated routines and hierarchically defined by the school institution. However, involve the use of some routines not always revealed and detailed explained, unless, as we indicated in previous sections, some circumstances arise involving the transmission of experiences teachers between the novice teachers in the workplace. Finally, in the field of professional activity, we observe that the actions of the teacher must be guided and conditioned by the peculiar and particular characteristics of the social group to which he belongs, adopts a gender of habits and procedures characteristic of the profession, defined by position or sector of activity in your work institution. In this way, we move the bi-dimensional figure to the plane of the profession. As we mentioned earlier, according to certain (PD) assumptions, in this context, students (teachers in initial or continuing training) should be familiarized with the knowledge institutionalized by the profession, that is, a repertoire of knowledge that goes beyond the limits of mathematics itself, but which enable them too effectively and competently exercise their social function.

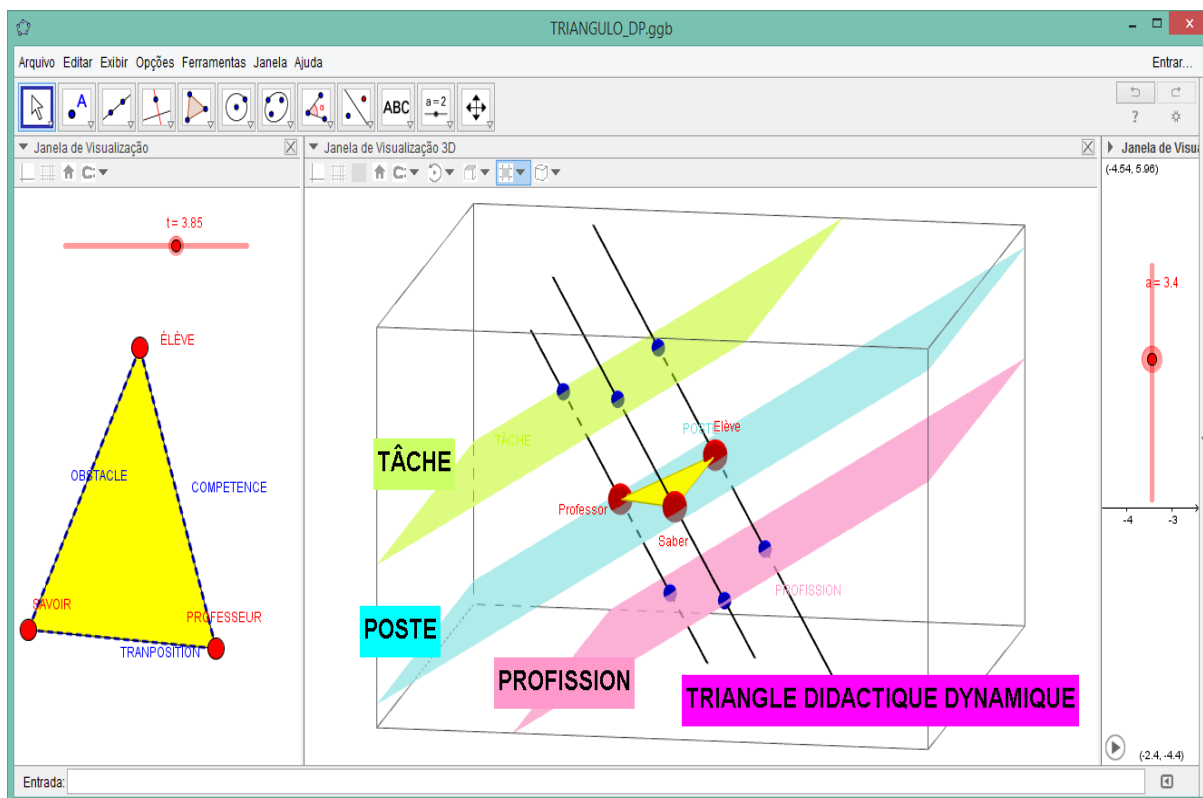


Figure 4. Visualization of the epistemic dynamic triangle of Didactics of Sciences defined in the field of the teacher's poste. (Prepared by the author)

In the figure 3, we consider as a legend: *savoir*=knowledged, *professeur*=teacher, *competence*=competence, *transposition*=transposition, *obstacle*=barrier, *élève*=pupil. In the right side,

we still consider the *tâche*=plan of activities, *poste*=the workplace, *profession*=professional activity, *triangle didactique dynamique*= dynamic didactic triangle.

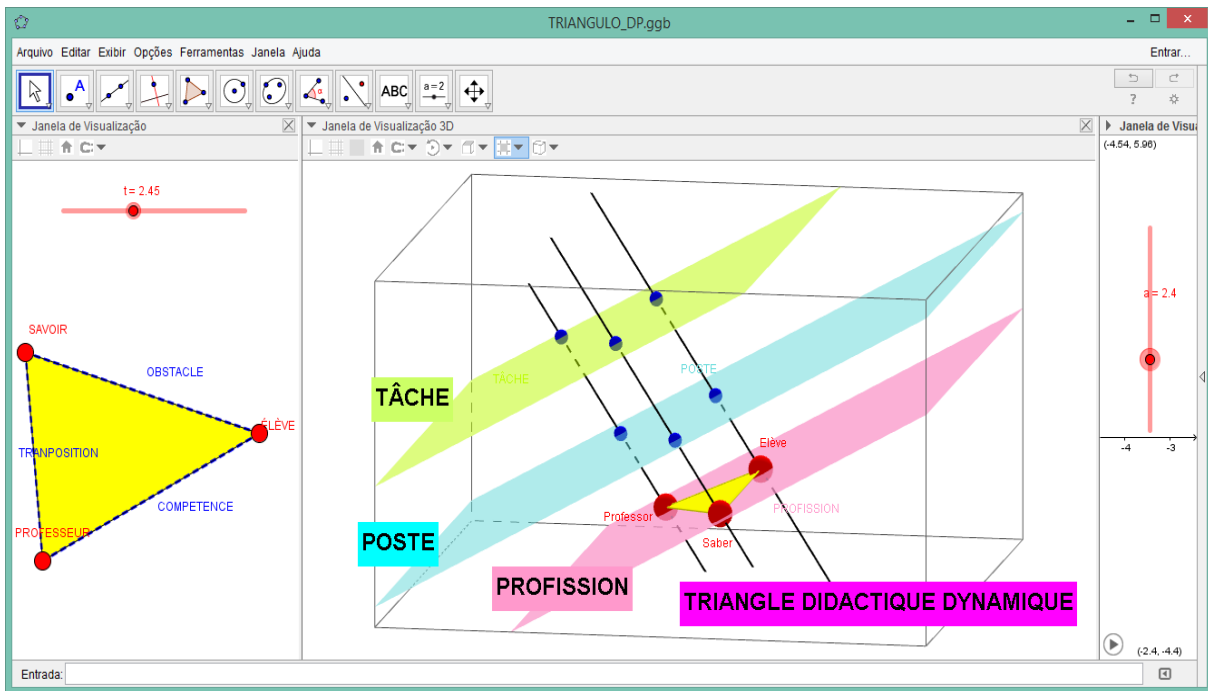


Figure 5. Visualization of the epistemic dynamic triangle of Didactics of Sciences defined in the field of the teacher's profession. (Prepared by the author)

In our last example involving the use of technology, with the aim of providing the acquisition and understanding of some notions and concepts originating from (PD) and Didactic of Sciences – (DS) and Mathematics, from a perspective of complementarity, we bring a construction with the software Geogebra, which allows the visualization of a three-dimensional dynamic figure. Thus, from an application of Baudouin's ideas (1999), the teachers in initial formation can understand the positioning of the three-dimensional figure on two distinct planes. We observe the vertices constituted by relations involving the elements: trainers - activity - learner - knowledge.

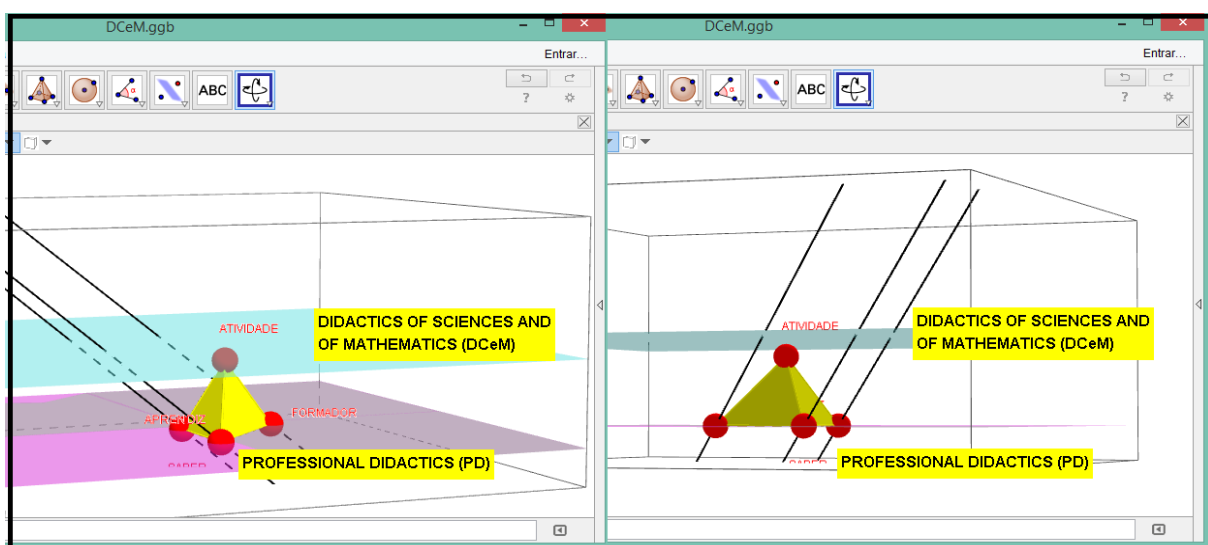


Figure 6. Dynamic representation of the Baudouin dynamic tetrahedron (1999). (Author's elaboration)

5. Conclusion

In the last sections we approached some assumptions of Professional Didactics – (PD) and, also, Didactics of Sciences – (DS). As we have noted, DP has a strong concern with professional situations and in a professional training perspective, of the acquisition of adult learning, with a view to the satisfactory acquisition of a set of routines and procedures desired by an institution and, in our case we are interested in the educational institution in Brazil. On the other hand, in the field of research in the teaching of Science and Mathematics we find that the relations and interests are directed, above all, on the processes of transmission and efficient didactic transpositions (Chevallard, 1991) in the classroom. Thus, we indicate the classical trinomial considered in Didactics, as constituted of the elements: teacher - students - scientific knowledge. But in Brazil, although we can perceive a certain tradition of studies and research around the Didactics of Sciences, however, in the case of Professional Didactics, we have a character still unexplored and of application, especially, as regards the character of complementarity that we seek to accentuate the course of the presente work.

To finalize our work, we bring a last example involving the visualization and the perception of certain conceptual relations originated and derived from the theoretical frame of reference discussed throughout the work. The geometric constructions supported by software GeoGebra have been used in Brazil with the aim of providing a scenario of learning and significations aiming at the initial formation of Mathematics teachers. The use of technology provides, for example, the representation of a dynamic tetrahedron that can be conditioned by the eminently pragmatic field of professional concepts and skills and, as well, in a field conditioned by the knowledge of classical academic sciences and, among them, we highlight the role of mathematical knowledge.

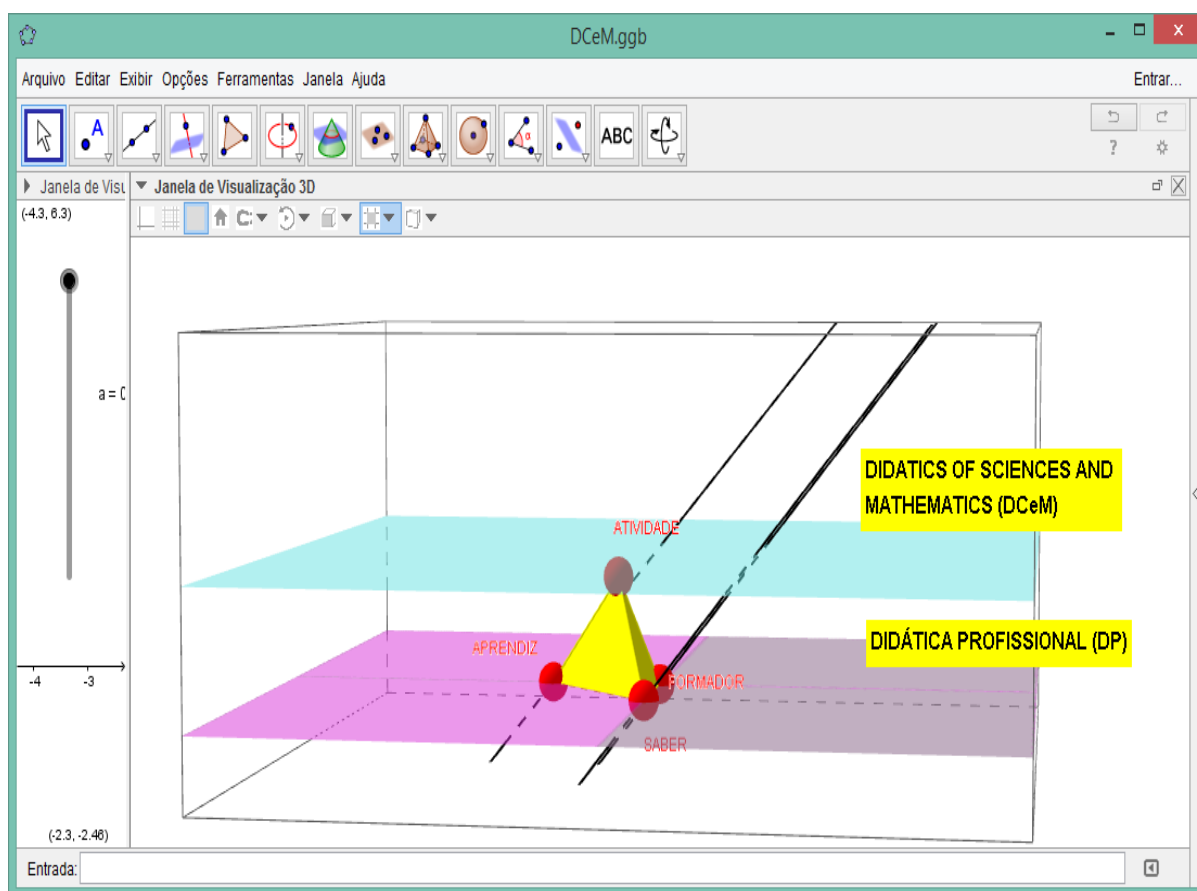


Figure 6. The dynamic representation of the Baudouin dynamic tetrahedron (1999). (Author's elaboration)

In the tradition of use in Brazil of the presuppositions of Didactics of Mathematics, we observe certain elements that require an extended systematics analysis aiming at understanding the crucial role and performance of the mathematics teacher. Indeed, in some studies we have identified such fragility

recorded by French specialists. Thus, given that we assume some assumptions from the (PD), we will have the possibility of adopting a global and systematic perspective that needs to understand the description of a set of professional competences built to the course of the professional's own learning.

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Authors

Francisco Regis Vieira Alves, Federal Institute of Science and Technology, Fortaleza, Brazil, e-mail: fregis@ifce.edu.br