Perceptions, Reflections, and Actions of the Teacher in the Classroom: An Instrument of Analysis

João Paulo Camargo de Lima
Universidade Tecnológica Federal do Paraná, Brasil, joaopaulo@utfpr.edu.br

Sergio de Mello Arruda
Universidade Estadual de Londrina, Brasil

Marinez Meneghello Passos
Universidade Estadual de Londrina/Universidade Estadual do Norte do Paraná, Brasil

Tamires Bartazar Araújo
Universidade Tecnológica Federal do Paraná, Brasil

Abstract: For decades researchers have considered as the main functions of the teacher in the classroom to be the teaching of the content and classroom management. Taking this concept of the dual role of the teacher in the classroom, the ideas of regarding the didactic-pedagogical triangle and aspects of Charlot's theory of the relationship to knowledge, we constructed a 3x3 matrix (table) called the Teacher Matrix as an instrument for analyzing teachers' perceptions, reflections, and actions in the classroom. The instrument was applied into the interviews of two teachers in activities in a teacher education program. The instrument was very interesting for identifying teachers' characteristic movements, as well as their perceptions, reflections, and actions from their speeches.

Keywords: Relationship to knowledge, Didactic-pedagogical triangle, Teacher's actions, Teacher Matrix, Teacher Education.

Introduction

Research on teacher practice in the classroom has been in evidence since the 1980s. In general, questions such as "What does it take to teach?" "What happens when the teacher teaches?" or "What actions does the teacher perform to instruct and educate the children?" (Gauthier, 2006) have been the starting points for studies that aim to understand teachers' actions, the knowledge necessary for their professional practice, and their relationship with effective learning in the classroom. Doyle (1986) points out two larger tasks that the teacher needs to accomplish in the classroom. One refers to the teaching of content, while the other relates to the functions of classroom management. Similarly, Shulman (1986) also points out two types of tasks or programs to be negotiated. The first deals with the organizational, interactive, social, and management aspects of class life. The second concerns school tasks, class content, and program. Gauthier (2006) and Tardif (2002) point out these two tasks as fundamental pedagogical functions exercised by the teacher. In a systematic study of published papers based on reports by the Holmes Group (1986, 1990, 1995) and the Carnegie Task Force, Teaching as a Profession (1986), Gauthier (2006) refers to these two functions of classroom management and content management as the very core of the teaching profession (Gauthier, 2006; Tardif, 2002). With the advancement of research regarding this dual function, we can observe the development of two lines of research: one includes studies that involve teachers' knowledge necessary for teaching (Shulman, 1987), where there was and still is intense production (Verloop, Driel, & Meijer, 2001; Tardif, 2002 and Gauthier, 2006). Likewise, classroom management studies have become one of the preeminent research lines (Evertson & Weinstein, 2006). Using the ideas of classroom management and content management proposed by Gauthier (2006), we propose that class and content management can be interpreted as the management of teacher relations with knowledge (content),

Lima, J. P. C., Arruda, S. M., Passos, M. M., & Araújo, T. B. (2020). Perceptions, Reflections, and Actions of the Teacher in the Classroom: An Instrument of Analysis. In V. Akerson & I. Sahin (Eds.), *Proceedings of IConSES 2020-- International Conference on Social and Education Sciences* (pp. 35-47), Chicago, IL, USA. ISTES Organization.

teaching, and learning within a triangular classroom model (didactic-pedagogical triangle). For this purpose, we based our work on the theory of the relationship to knowledge (Charlot, 2000) and on the didactic system (didactic-pedagogical triangle) concept presented by Chevallard (2005) and Houssaye (1988, 2007). Considering the studies and foundations described above, we constructed a theoretical-methodological instrument for the analysis of teachers' perceptions, reflections, and actions in the classroom called the Teacher Matrix (Table 2) (Arruda; Lima & Passos, 2011)[1]. To present the fundamentals and construction of the Teacher Matrix, as well as its application, this work is organized as follows. Some concepts of content management and classroom management are presented initially. In the following section, some conceptions of the classroom, the didactic-pedagogical triangle, and Charlot's theory of relationship to knowledge are presented. Next, we present the Teacher Matrix as an analytical instrument and, in the methodological procedures, an application of the instrument is carried out from an interview with teachers. Finally, some considerations are pointed out.

Some Concepts Of Content Management And Classroom Management

In general, classroom management refers to the actions teachers take to create an environment that supports and facilitates students' academic and socio-emotional learning (Evertson & Weinstein, 2006, p. 4). Similarly, Gauthier et al. (2006, p. 240) point out that classroom management refers to a "set of rules and arrangements necessary to create and maintain an orderly environment conducive to both teaching and learning." The author further adds that classroom management involves maintaining order in the classroom by planning rules, disciplinary measures, establishing routines, and developing responsibility etc., which aim to make the learning environment conducive to learning (Gauthier et al., 2006, pp. 240–273).

Gauthier et al. (2006, p. 138) define content management as "the set of operations organized to lead the student to learn the content." This would be the task of "giving the program, of ensuring that students master the various elements of content, of instilling a taste for the study of diverse subjects, etc.," which may include content planning, activities, objectives, strategies, evaluations, and so on (Gauthier et al., 2006, pp. 196–240). To conclude, both Tardif and Gauthier consider content management and classroom management to be "the very heart of the profession" (Tardif 2002: 219), yet, by emphasizing only the management of content and class, they seem to forget that the teacher—as a person and subject—"must also manage his own learning, his own development," so he must be included among the tasks that structure the teacher's actions in the classroom (Arruda, Lima, & Passos, 2011, 143). It is necessary to rethink the tasks of the teacher in the classroom to find a way to include the task of managing one's own development.

A possible way to do this can be realized based on the concept of the didactic-pedagogical triangle of Chevallard (2005), Houssaye (1988, 2007). Therefore, it is proposed that the teacher's tasks go beyond these two functions: more about managing epistemic, personal and social relationships with knowledge (Arruda, Lima, & Passos, 2011) and relationships with disciplinary content, teaching and student learning. As we explain below some concepts about the classroom, the relationship with knowledge and the conception of the didactic-pedagogical triangle, it becomes clearer the main ideas and foundations for the construction of the theoretical-methodological instrument that we call the Teacher Matrix.

The Relationship to Knowledge In the Classroom and the Didactic-Pedagogical Triangle

The classroom itself has a range of complicated situations that are inherent to the complex conjunctures that make up the educational environment. At all times, there is an incredible amount of visually complex information that teachers need to process to understand what is occurring. Teacher assignments in the classroom involve observing student behavior, monitoring student interactions, keeping pace with instruction, making quick decisions about how to intervene in classroom disruptions, and other pedagogical concerns (Wolff et al., 2016, p. 244). Faced with the numerous actions to be carried out by the teacher, it is fundamental to establish models for a better understanding of relationships and pedagogical activities in the classroom. For example, for Doyle (2006, p. 98), a typical classroom is, from the ecological perspective, " an environment in which, typically, 20 to 30 students—a class—are gathered with one or perhaps two adults (teachers) to engage in activities, which have educational purposes and outcomes for the students." In the ecological perspective, which most recently dominated research on classroom management, the central idea is "habitat, the physical niche or

[1] An initial version of this analytical instrument is presented in Arruda, Lima, & Passos (2011).

context with characteristic purposes, dimensions, features, and processes that have consequences for the behavior of occupants in that setting." (Doyle, 2006, p. 98). From the ecological point of view, behavior in everyday life is limited by the particular setting in which a person is situated at a given time (Doyle, 2006, p. 98).

Another possible representation of the classroom is what we refer to as the didactic-pedagogical triangle (Arruda, Lima, & Passos, 2011; Arruda & Passos, 2017), also known as the didactic system (Chevallard, 2005), the didactic triangle (see Friesen & Osguthorpe, 2018, p. 256), or pedagogical triangle (Houssaye, 1988, 2007; Meirieu, 1987, Friesen & Osguthorpe, 2018). The didactic-pedagogical triangle has Platonic origins (Gauthier; Tardif, 2013) but was represented and structured in several ways via different approaches by various authors. This representation that we call the didactic-pedagogical triangle consists of three "places" and their interrelationships (Figure 1), where T represents the teacher, S refers to students, and K is related to knowledge and their inter-relations.

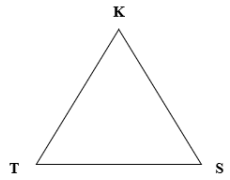

Figure 1: Didactic-Pedagogical Triangle

Friesen and Osguthorpe (2018) refer to it as a pedagogical triangle and point out that the triangle is an elementary heuristic structure that can be used to analyze specific interrelationships and interactions between the teacher, students, and knowledge (content) in a given pedagogical situation. Contrary to how authors such as Chevallard, Houssaye, and Friesen and Osguthorpe have interpreted the didactic-pedagogical triangle, for us the didactic-pedagogical triangle can be considered a system of relations with knowledge, which involves the teacher (T), the students (S), and knowledge or content (K).

The relational model of the classroom inserts a didactic-pedagogical triangle, made up of the ideas of Charlot, (the physical environment, the included knowledge); a subject (the teacher); and the other (the students). With the classroom as a relational system, the behavior, or rather, the conduct of the actors involved, is more complex, since it considers subjectivity (the self) and society (the other). We consider that S is the subject that learns, which can be a classroom, a group of students, or a single student; T is the subject that teaches, that is, the teacher, the monitor, or a student teacher during the professional stage; K is the knowledge to be taught and can be a discipline, content, a concept, etc. With this in mind, we assume the following interpretations and definitions for the edges of the triangle:

- S-T (or T-S) indicates the relationship between the teacher and students and represents teaching.
- S-K (or K-S) indicates the relations between the students and knowledge and represents students' learning.
- T-K (or K-T) indicates the relationship between the teacher and knowledge and represents teachers' learning.

On the other hand, we can also reinterpret classroom management and content management as relationship management, because, as previously described, the didactic-pedagogical triangle can be understood as a system of relationships to knowledge in a standard classroom where they are present, in which S is the "student group," K is the "knowledge to be taught," and T represents the "teacher." In this way, the main tasks of the teacher (T) in the classroom can be thought of in terms of three types (Arruda, Lima & Passos, 2011, p. 147):

1. Management of the T-K segment: which concerns the management of teacher relations with content;
2. Management of the T-S segment: which is related to the management of the teacher's relationship to teaching;
3. Management of the S-K segment: when we consider the management of teacher relations with learning.

This interpretation of the didactic-pedagogical triangle as a set of relations to knowledge in the classroom leads us to commune with the theory of Charlot (2000) on the relationship to knowledge. For Charlot, the question of knowledge originates in an original anthropological condition: the human being is born inscribed in a world (symbolic) in which he or she is subjected to the necessity or obligation to learn, since subjects can only exist if the human being is learning about, appropriating, and relating to the world (Charlot, 2000, p.59–62, 2005, 57).

The relationship to knowledge is defined, fundamentally, as "a form of relation to the world" (Charlot, 2000, p. 77) by Charlot, who describes it as,

> [a] world in which I find myself as a human being and driven by my desires, occupying a position in a social space and endowed with a history that defines my singularity and way of giving meaning to this world. (Charlot, 2000, p. 33)

That is:

> The relationship with knowledge is the relation of the subject to the world, to himself and to others. It is the relation to the world as a set of meanings, but also as a space of activities, and it is inscribed in time. (Charlot, 2000, 78)

If we consider the classroom as the focus of research, we can understand the relationship with the world as the relation of the subject to the school world, that is, with a specific purpose— the field in which school knowledge and other actors of this environment are present such as the students, the subjects who will learn such knowledge; the teachers, who are dedicated to teaching and transmitting this knowledge; the directors, supervisors, pedagogues, etc., and all the physical aspects of this world (buildings, classrooms, portfolios, etc.) (Arruda & Passos, 2017). For this specified world, we can adapt Charlot's (2000) definitions of epistemic, identity, and social relations to knowledge (Charlot, 2000, pp. 68–74) as specified in Table 1:

Table 1. Epistemic, personal, and social relationships to knowledge

A.	The epistemic relationship to knowledge: Refers to the relationship to knowledge as an object of the world to be appropriated and understood; knowledge endowed with independent objectivity, consistency, and structure; knowledge "existing in itself," "deposited in objects, places, and people," and immersed in a "universe of knowledge distinct from the world of action, perceptions, and emotions" (CHARLOT, 2000, p. 69). Subjects demonstrate an epistemic relationship with the school world when they use purely intellectual or cognitive discourses on teaching, learning, and events occurring in this universe, expressing themselves in general through oppositions of the "I know / do not know" type, "I know / do not understand," and "I understand / do not understand," etc.
B.	The personal relation to knowledge: Refers to the "relationship of identity to knowledge"; knowledge as an object that makes sense, which is part of the subject's personal history, and his or her life and expectations (CHARLOT, 2000, p. 72); it is knowledge as object of desire, of interest; the knowledge that the subject "likes" and that mobilizes the subject in his or her search. Subjects demonstrate a personal relationship with the school world when they use speech that refers to feelings, emotions, senses, desires, and interests, expressing themselves in general through oppositions of the "I like / dislike" type, "I want / do not want," "I feel / do not feel," etc.
C.	The social relation to knowledge: Refers to the fact that the subject is born inscribed in a social space and occupies an objective social position that defines the initial context in which it is related to knowledge; in this medium, knowledge has value given by the community in which the subject lives, receiving the impact of the expectations and aspirations of others in relation to him- or herself (CHARLOT, 2000, p. 73). Subjects demonstrate a social relation with the school world when they use discourse that involves values, agreements, precepts, beliefs, and laws that originate inside or outside the school world, expressing themselves in general by means of oppositions of the "I value / do not value," "I should / should not," and "I can / cannot (I am or not authorized to do)," etc.

Considering the didactic-pedagogical triangle and the epistemic, personal, and social relations to knowledge, we constructed the Teacher Matrix, which is described next.

The Teacher Matrix, an Analytical Instrument

When we apply epistemic, personal, and social relationships as defined in Table 1 to the classroom now represented by the didactic-pedagogical triangle as shown in Figure 1, the triangle becomes a prism (Figure 2), which we call the didactic-pedagogical prism.

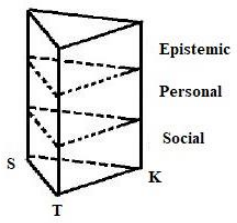

Figure 2: Didactic-Pedagogical Prism

The didactic-pedagogical prism is configured as an instrument of interpretation of the relation to knowledge, teaching, and learning that develops in the classroom. However, its true dimensions become more apparent

when unfolded in the matrix that is associated with an operation that in geometry could be called "planning." In fact, if we open the prism on its vertical faces, we obtain what we call the Teacher Matrix (Table 2).

Thus, in addition to being an instrument of interpretation of the relation to knowledge, teaching, and learning in the classroom, the Teacher Matrix provides us with classroom management and content management that can be thought of as relationship management in the classroom. From the application of the didactic-pedagogical triangle and epistemic, personal, and social relationships with knowledge and keeping in mind the rethinking of the functions of the teacher in the classroom in terms of classroom management and content management, we can construct Table 2 described below, called the Teacher Matrix[2] (when we consider the internal cells, in this case, the "Sector" cells).

Table 2. Teacher Matrix.

New tasks of the teacher **Relationship of teacher** **Relationships with knowledge**	**1** **Management of the T-K segment** **Content**	**2** **Management of the T-S segment** **Teaching**	**3** **Management of the E-S segment** **Learning**
A **Epistemic**	Sector 1 A It concerns content as an object to be understood by the teacher and the epistemic relationship of the teacher to the content; the quest to understand it more and more; the relationship to objects, people, and places that can contribute to improving their understanding of the content such as books, journals, videos, internet, libraries, universities, etc.	Sector 2A It concerns teaching as an activity to be understood by the teacher and to the epistemic relation of the teacher to the teaching; the quest to understand it more and more; the relationship with objects, people, and places that can contribute to improving their understanding of the teaching such as books, journals, videos, internet, libraries, universities, etc.	Sector 3 A It concerns learning as an activity to be understood by the teacher and to the epistemic relation of the teacher to the students' learning; the quest to understand it more and more; the relationship with objects, people, and places that can contribute to improving their understanding of learning such as books, journals, videos, internet, libraries, universities, etc.
B **Personal**	Sector 1B It concerns content as a personal object and the personal relationship of the teacher to the content; the sense that the content acquires for the teacher and how much it determines his or her professional identity; how much the teacher likes and gets involved with the subject he or she is teaching; how the teacher evaluates his or her own understanding of it, etc.	Sector 2B It concerns teaching as a personal activity and the personal relationship of the teacher to the teaching; the sense that education acquires for the teacher and how much it determines his or her professional identity; how much the teacher likes and engages in the act of teaching; how the teacher evaluates his or her own pedagogical activity, etc.	Sector 3B It concerns learning as a personal activity and the personal relationship of the teacher to the students' learning; the sense that learning acquires for the teacher and how much it determines his or her professional identity; how much the teacher likes and engages with the students' learning; how the teacher evaluates the learning of his or her students, etc.
C **Social**	Sector 1C It concerns content as a social object and to the values of the teacher in relation to the content that he or she teaches; how much the teacher shares in a community of educators and their exchanges and practices regarding content; the teacher's talks with the administrative authorities regarding the content that he or she teaches.	Sector 2C It concerns teaching as a social activity and to the values of the teacher in relation to the teaching that he or she practices; how much the teacher shares a community of educators and their exchanges and practices regarding teaching; the negotiations of the teacher in administrative instances with respect to teaching practices, etc.	Sector 3C It concerns learning as a social activity and the values of the teacher in relation to the students' learning; how much the teacher shares with a community of educators and their exchanges and practices regarding learning; teacher negotiations with administrative authorities regarding student learning, etc.

[2] It can be observed from the didactic-pedagogical triangle represented by Figure 1 that the relations established in the classroom can be seen and analyzed from three points of view: Teacher, Student, and Knowledge. Three analysis matrices are generated: The Teacher matrix, Student matrix, and Knowledge matrix. The three instruments were developed. For now, we will present the Teacher Matrix, which is the first of them. More detail can be found in the reference Arruda & Passos (2017) (in the Portuguese language).

The Teacher Matrix is used as an analytical instrument by applying it to the semi-structured interviews of two teachers, seeking to analyze their perceptions, reflections, and actions during the activities performed in the classroom, as we will see below.

Methodological Procedures and Research Context

The research was developed in a teacher education program in the context of the development of a Scientific Initiation Project in a city in the North of Paraná, Brazil. Participating in this project were teachers who developed activities based on the perspective of inquiry-based learning with fifth-year elementary school students. The training consisted of three stages.

The first stage of the project refers to a training course for pedagogical coordinators, principals, and some teachers, for a duration of four hours, to structure the research stages developed by the students.

In the second stage, the coordinators reviewed the guidelines received in the training course for teachers who could not be present at the training.

Then, the teachers planned and developed research activities, in which students defined research problems, developed, and carried out research, and completed their work, which will culminate in the presentation and communication of the studies developed.

After closing the activities, we conducted semi-structured interviews (Clandinin & Connelly, 2000) with the teachers participating in the program activities, and the triggering questions for the collection were: “Tell us a little about your professional life history.” “How was participating in the project for you?” However, once the teachers gave their testimony, other questions were formulated with the intention of deepening the discussion and detailing their comments, perceptions, and reflections regarding participation in the project and execution of the proposed activities. Due to the large amount of data obtained and the limited space for the presentation of the data, we considered the interviews of only two teachers, called teacher T1 and teacher T2. The interviews were categorized according to the usual procedures of content analysis (Bos & Tarnai, 1999; Bardin, 2007).

The data were used in the processes of interpretation and analysis, the excerpts from the T1 and T2 responses were categorized from the Teacher Matrix (assuming the matrix sectors as a priori categories), showing the distribution in terms of the matrix descriptors in the sequence. These results were analyzed and systematized to reveal teachers’ perceptions and reflections on experiences with the development of the proposed activities in the teacher education.

Presentation and Analysis of Data

For the presentation and analysis of the data from interviews with the teachers in the research, designated T1 and T2, we adopted the following procedure:

1. We initially present the transcription of a part of a speech, for each research subject; the sentences are formed by phrases, each indicated by a number.
2. Next, we present a version of the Teacher Matrix (Table 2) for each subject, with sectors filled in with the numbers of the sentences, according to our interpretation.
3. Next, an analysis with a brief commentary on the characterization of the subject from the distribution of their sentences is performed.

Teacher T1

I lived in City A. I worked in City A 6 years as a temporary teacher. (1) I then took the contest in Cty B, and I am working for 4 years and I am also working for 1 year in City C. (2) I have a degree in Pedagogy and a postgraduate degree in inclusive education and psychopedagogy. (3) In City C I worked at Santos Dumont School with the Science project (4). It was very rewarding and I really enjoyed developing the project. (5).

It was a challenge, a very big challenge (6). At first, there was some fear and insecurity about what the project would be (7), but from the moment the project began, it sparked the children's interest (9), so, in the end, it was very gratifying—very much so—(10) to see their interest in the research, to ask (11): "No teachers; people were missing, but tomorrow, let's ask again!" (12) For example. The students that did the research interviewing the teachers. Wow! Their interest! (13) It was very gratifying indeed! (14) Seeing them seeking information, (15) chasing after it and if it didn't look good, and doing it again! (16) "Teacher! Come help us! "(17) Sitting with them and helping them was really great! (18) I think it was a very nice growth for me too. (19).

The course was very good because it provided a base (20). We got a little scared because it was new (21), but we already knew what it would be (22), so it provided a basis (23). Then, we started (24) and knew more or less how it would be (25), what the final product would look like (26), what type of guidance people would provide (27), Was very good! (28) The positive point was this growth both for me as a teacher (29) and for the students as well. This involvement, this growth, (30) this way the student became closer to the teacher. (31) It was very good! It was very rewarding indeed! (32).

It was busy, time went fast, (33) in the research. You helped a lot, the emails etc. (34) This support you gave was important, very important (35). However, it is a question of time (36). There is some anxiety as a teacher (37) because that was a short time (38), and we want to see the end result soon (39) but with more calm (40). This support you gave was reassuring and very reassuring.

If I would participate? Yes, I would participate! (41) Because seeing this growth of the students, (42) this involvement, being closer, (43) researching together, (44) this growth, both of them (45) and ours as well. (46) Because you gave support, (47) it was really good. (48) We had the confidence to be doing and growing together. (49)

I tried to start from the content we were working on (50) and from their reality (51). Then, we talked to them (52) and resumed some of the content that was being worked on (53). They asked questions (54) based on their interests (55). From there, we were already planning (56). They organized the team. (57) They even put team´s name. (58) It went well! (59) I was leaving them choose and chose then the names also. (60) I went to look and said, I want teams like that. (61) A student was getting lonely, so I said no, there's this group here. (62) So, at first I left and then I started to mediate the activities (63), but I left them there (64). I suggested, I said: group 1, group 2, "And if it has a name?" (65) Wow, that's where they went, so they wanted to draw (66), so I got involved with them (67). I got organized (68), but from the content that we had, I went to work (69) from some themes (70). There were children who brought some information from home because they went searching. (71) Already had content that had been worked. (72) Students were pointing, "I googled about candy!" "I googled about food!" (73) Some brought it from home research and (74) we also tried here at school, (75) but due to problems with the internet, we couldn't do it in class. (76) Then we ended up bringing some papers to them, (77) to complement the research done. (78) Each group had the texts (79). They read and scratched out (80). It was not only one paper, there were more papers (81), so they read and rephrased (82), then talked among groups (83). There was information that was found in one place and in other places. (84) There was information that matched, which matched in some papers, (85) and they said, "this one does not have on mine". (86) There were children who sought something else (information, content) from this paper and brought it into the classroom. (87) The students were writing the work. (88) Later, from this initial text, they were already developing and writing (the research text) (89) and also had the logbook. (90) In this diary the theme was chosen, and they wrote down everything. (91) After each step they took, they scratched, wrote again, and called me to show it. (92) Was worked a lot in groups, each one in its group. (93) They called me I went from group to group (94) answering, doing everything with them, (95) and at each moment of the research they registered. (96) In this way, even conclusions they wrote, (97). Sometimes, they wrote in sketches and later in the logbook (98), because one was writing, the other was writing, each one wrote (99). Then they read, summarized, and joined, (100) so it was good teamwork (101). They went on helping each other (102): one read a text and said, "I don't get it!" (103) There, they changed the text, (104) then I said no, you can change it (105): one team member can help the other (106), and you must learn to work together (107). That was cool (108) for them too (109).

It was based from what they wanted to choose, (110) so they raised the subjects. For example, illness, (111) pain, gastritis, arthritis, etc. From there, we narrowed the search. (112) But it was based from what they wanted to be researching. (113) I was helping with the topics, to not get too broad, (114) but always from what the team would like to research. (115) So first, it was workout on the board, (116) then they jotted down (117) and it was between 2 subjects, and from those 2 it was chosen. (118) It was pretty hard to choose too. (119) Then, to define

the problem, I also had to help them. (120) Because one spoke, another also spoke. (121) So, I directed. But let's think. What can we do? (122). Then, it was always with them from there (123), sometimes on the board, sometimes on the paper sheet. There, I went back to the board again (124). Because of that, the team sometimes voted between them (125), but it was cool like that (126) because they were getting along (127).

We started in June and ended in July (128). It was held in a month! (129) One class passed by my lab three times a week, and the other passed two times (130), so what did I do? (131) For example, in this class I gave less work and I exchanged with another class. (132) I asked the teacher to be with a class to that I provided the most work and service. (133) I asked to change, so that I could develop the activities of 3 out of 3. (134) After a while I was more in the individual service, (135) each working on his/her writing. (136) So I took group by group. (137) Because when they were with me in class, each one in their group and I attended individually. (138) They said, “Teacher!” (139) Read it. How was it? (140) While I was attending a group, the others were doing their work. (141).

We develop the activities as follows. While each was inside still the working on something they had not yet finished, and they kept working to finish. (142) Then if I am working with a group and they are not done. (143) I asked, what is the relation? (144) Linking a little with what we had learned in the classroom and then we continued the development of the activities. (145) We seek to do such work this way. (146) I was reading and after the group that was last, we asked: how this reading is linked to what we learned? (147) Then they commented on it. (148) This was for those who had not done all the reading of the content. I was doing like this way. (149) This way of working I did when I was at the end of the activities. Some groups had already finished. (150). Classes were one hour long (151) in the beginning. They were a little shorter in June (152), but then in July, when I came back, it was one hour (153). There were five classes reduced to four classes in the period (154); they occurred three times a week, and each lesson lasted one hour (155). It was a good time (156) before when there were five classes; they gave 50 minutes of class (157), ours was well … (159) but they were already forming the group and knew what was going on (159), then so, only in the very first days, but then they already ... (160) They said, “But, is it over, teacher? Change the class!!” (161) They wanted to stay like this ... (162).

If there was learning? There was learning, (163) especially like this, when they were going to talk about their work, (164) the conviction they were talking about. (165) When some of them presented the work to their friends, I realized that they got very nervous (166), and we talked like this: “Talk your way!” (167) So, the first time here is ours ... I said, “Be calm, people!” (168) “Let’s introduce the class!” (169) Then, it was quieter (170). “Oh my god,” they said (171 When they presented and a little friend stopped talking, the other kept saying “We did not do it that way, and we summarized our research the other day!” (172) It was amazing when the friend (student) was presenting (the research), you realized that they were paying attention to what others (colleagues) were presenting (173). As it was a subject about food, they commented: “we could have put that part of the content in ours too!” (174) It was very cool (175), both for them and for the other classes they presented (176). The other classes wanted to do it too (177); they said, “When are we going to do it from there?” (178) “How did you do the research like this?” “When are we going to do it?” (179) So, I said, “Look, in the fifth year you will be performing” (180). “Wow, but only in the fifth year?”

I believe so (there was learning). (182) Looking into their reality. (183) Let's think. The science content (they have contact) only here at school? (184) No, it came out of here (this conclusion that the content of the science subject is not present only at school), let's say so. (185) They saw that food is on daily life, in people's daily lives, (186) so they (learned it). I believe so. I thought to myself, “Look the kids know, they have this knowledge !!” (187) It was very cool! It is as if they were researchers, (188) and they were working there, investigating, it was very cool. (189) Brought knowledge, professional growth, experience (to me). (190) They felt very important, (191) it was very good that they went there and presented (the search results). (192) Because when they had the presentation here at school for their parents, they wanted to be presenting (they wanted to present). (193) They could stay there (place the posters were presented as a result of research), they would pass by (looking, watching). (194) At the time they were setting up (poster placement structure), they would say, “Can we stay here alreadyt?” (195) It was very good (196).

Table 3. Allocation of the narrative excerpts of Professor T1 in the Teacher's Matrix sectors

New tasks of the teacher **Relationship of teacher** **Relationships with knowledge**	**1** **Management of the T-K segment** **Content**	**2** **Management of the T-S segment** **Teaching**	**3** **Management of the E-S segment** **Learning**	
A **Epistemic**	**1 A** 23, 26, 50, 51, 53, 69, 70, 72, 74, 76, 77, 78, 85, 91, 96, 110, 112, 113 118, 174, 183, 184, 185.	**2 A** 6, 19, 22, 33, 36, 38, 41, 46, 56, 61, 63, 64, 65, 68, 75, 90, 104, 105, 107, 114, 116, 120, 122, 124, 128, 129, 130, 131, 132, 135, 136, 137, 138, 140, 143, 146, 147, 149, 151, 152, 153, 154, 155, 157, 167, 168, 169.	**3 A** 12, 13, 15, 16, 42, 45, 66, 71, 79, 80, 82, 87, 88, 89, 92, 97, 98, 99, 100, 103, 106, 111 117, 121, 127, 142, 145, 148, 150, 159, 161, 163, 164, 165, 171, 172, 173, 177, 186, 187, 191, 193.	60%
B **Personal**	**1B** 21, 25, 28, 29, 119.	**2B** 1, 2, 3, 4, 5, 7, 10, 14, 32, 37, 39, 40, 48, 108, 156, 158, 190.	**3B** 8, 9, 11, 18, 30, 43, 44, 55, 59, 109, 126, 162, 166, 170, 175, 182, 188, 189, 192, 196.	24%
C **Social**	**1C** 20, 27, 34, 47.	**2C** 31, 35, 49, 52, 54, 67, 94, 95, 123, 133, 134.	**3C** 57, 58, 83, 93, 101, 102, 115, 123, 125, 141, 176.	16%
	18%	38%	44%	100%

When finding the interview fragments in Table 3, the presence of these fragments is evident in all sectors of the Teacher Matrix. The reflections and perceptions of T1 on their actions during the activities developed are predominantly in the columns referring to the teaching taught (column 2) and student learning (column 3), thus expressing their concerns, difficulties, and successes in the development of their practices, and especially student learning, which has the largest number of excerpts characterized in this column (column 3). A lower incidence of speech is identified regarding the reflections and perceptions about content taught or the knowledge developed by the teacher (column 1). When we look at the lines that concern the epistemic (A), personal (B), and social (C) relations, a greater number of sentences are identified with the epistemic relations of the teacher, with a predominance of the reflections of the teacher in the relations epistemic with the act of teaching (2A). There are also many passages from the speeches characterized as epistemic relations with learning (3A).

We then observe that some reflections presented with relatively higher incidence in terms of personal relations with learning (3B) and teaching (2B), expressing interest and a taste for the development of the activities. Finally, it is possible to observe a lower incidence in the sectors of the matrix associated with the relation of the social to knowledge, with emphasis on sectors (3B) and (3C), presenting perceptions and reflections about social relations with teaching and learning.

Teacher T2

I have been here in the network of ... since January 2015, so this year, I am new here and new to the profession (197). I had worked already but in early childhood education, so the first contact with elementary school was here in the municipality of ... (198). I graduated 3 years ago, will complete 4 years. My education is in pedagogy, and I have a master's in education (199) in Early Childhood Education from a private network school (200).

For me as a person—I'm going to talk as a person—I loved it (201). When we went to the meeting, I did not know the proposal, and when we started talking, we got anxious (202) because of working (203) as a professional I've always been in this environment. For me, it was very good (204). It was very good because I had already worked for a long time with Scientific Initiation (205), so I kind of passed on to children my passion

for initiation (206), for this work. I think it was what helped facilitate the process (207), but I do not know if it was because we did it in the fifth year (208). I had no difficulty while the children were able to keep up with the work, and it was quiet (209).

On the strengths (of the project). I consider the following points first: the work differently, inserting children into this research environment (210). In the classroom we cannot do this, daily life does not allow (211). So, do in the laboratories, where the all-day schools have this possibility (212). Working differently in the classroom (213), involving children in things they are not used to (214), or even know that existed (215). So, prepare them for the future (216), because today more and more people are seeking higher education (217). In this way, they will already be used to it (research), as well as knowledge (218). They research, they build their knowledge (219), do we help? They are there (doing the research) step by step. It is not a thing (a way) that I transmit knowledge already produced (220), and they get there and absorb the knowledge, and everything is fine (221). They built, they saw and interacted (222). There were some things that didn't work out and they got upset (223) but understood that it's part of the process (224). So, for us as teachers it was a gain (225), but for them it was a lot more (it was a bigger gain) (226).

Only thing I think is the question of time (to implement and execute the project activities). The time to do the work (227). I understand. I know it was a new idea of the activities to applied on the system (county education system), when we went there on the course, and then we went back to school. I started working with the students (228). But we stagnated at the beginning (there was no progress of the activities), because we did not receive the information of the dates and deadlines, and when it arrived the information, it almost no time (229). We had not done the research yet (230). We used the Interviews, because we choose to use interviews as data for research (231). So, it got busy (232) and I had this class with them once a week only. (233). If there was a possibility to have more time, it would be more elaborate work (234). It was a little fast (235), but it went well. But if I had a longer time .... I don't know if it possible to change the number of classes in the class, spend more time (per week). If it was a longer period. I think it would be better (236). I would certainly participate because I like research work (237), I saw that it worked (238), the children liked it (239), and it was a pleasant job for the teacher (240) and for the students (241).

When I returned the school, I showed the children the material we took in the course, and I said to them that the other children had done research (242). I showed the other children's subjects as example and let them choose (243), (later) I didn't let them choose too much so that they wouldn't stir away (from the content), because things might start to emerge (subjects that aren't part of the content) (244). .. So I delimited a few things. I showed them what could be researched and what would be too broad for us (245). I talked with them about it and did the methodology with my science class and here in the computer lab (246). We worked together, then did research (247). When I chose a theme I started to plan (248). A difficulty of the school is that there's the internet, there's the lab, there are computers, but there's no internet, so it made it a bit difficult, too. What did I do? When they chose a theme, I would go to my house to search for articles (249) and bring them to them. Then, they would join each group, read the text, and summarize it in computer class (250). I have been working with this material (251). I worked with tables, with graphs, then I set up slides, and I showed them to them here in room (252). In the notebook they recorded what they had understood of each item. Then, when we finished this phase, they understood each part and produced summaries (253).

We began writing, uniting the two (activities done in science classes and activities in the computer lab), wrote here (science classes) and wrote there (computer lab) the research itself (254). In the beginning, I brought texts to them of research and elaboration of research— step by step texts (255). I was showing here and they were reading there and making brief not to get a little confused (256), me teaching one thing (activities and tasks) here (science classes) and them doing there (computer lab) something else (activities and tasks) (257). It was when they understood that the research had several stages and they had to write and do each of these parts (258). When we started, I brought the texts of each of the themes, and they sat in a group. Everyone had to read, based on their own dynamics: in one group, one member read and discussed, while in another, everybody read and organized themselves (259); that was quiet, and from there, we worked that way (260).

When I suggested the subjects. I didn't suggest! When I showed the topics that (other) children researched with the other teacher (261). They were already interested in some (262), so I said they could not be the same. To find different ones, I sat with each group and gave them a science book, the journal of Children's Science Today (263), to inspire some themes (264). While the other groups were thinking, I would sit in one group and say, "Let's work like this. Food? What about food? As? What are you thinking?" (265) So, they talked about a lot of

things, and it was like that. I went from group to group and we closed all the issues and problems (266). This was done with three classes of three groups each. Each class was held once a week, but they had two classes. each class lasted 1 hour and (did the research activities) a little bit in each class. But in the computer lab, the teacher didn't just work on it (the research activities). Here it was just that (research activities). When she worked (the teacher of the computer lab) they had 2 classes, when it wasn't just me (only one class) (267). While I was developing the research, they did not develop other content, but the themes were within the contents. They didn't stir from it (the subject). One group talked about feeding, while another discussed ultraviolet rays, a topic also included in the content. That way it didn't stir too much (from the theme) and until you sent the schedule with the dates, I was working like this (268). Because there are 2 classes, right. A part of the class I worked with contents and the other with research. When the dates were sent, the deadlines, the time left (for the deadline) was short. I said, "let's work only on the research until it's over," so we developed it this way (269), so I think if there is more time, we can reconcile the two (content and research) (270). Because [...], what if a research is not linked to the contents. We would have to work with both of them anyway. No problem! (271).

I remember, we worked we worked without the return (information) of deadlines for about a month, but nothing concrete, we had not even started, I was in this process of teaching the parts and doing the resumes (272). When the deadlines came, it was another one month, so let's say two months until the delivery for the preparation (of the posters of the research presentation). It was short! (273)

The very day I saw (the posters with the survey results) was at the presentation, I think it was a milestone (meaningful to me) (274). I saw them explaining; we got anxious (275). I said, "They will not succeed (276). We're afraid, right? They will not make a mess." We get more nervous than them. I was anxious and that, but when I saw them explaining, how cute!! (277) And the other students also from the other schools and they were convinced, right, "I did! I learned it!" (278) So, at that moment, I saw that the work was really worth it (279), because while you're in the room, they're talking, they're still involved (280), and there's a little friend to help (281). When I read the texts (to evaluate and revise). I was there with them, and there was always another (colleague, friend of them) to help (282). So, when they sat down (at the location of the presentation), and they were in front of people who didn't live with them and started explaining to people without reading the supporting text, I said, "Oh they learned!" (283).

I realized (that they learned). When we were finished with the research, and I returned to the contents of the class. Everything I was going to talk about the subjects of the class. Everything we said (in class) they mentioned and discussed: "Look, teacher, you can search!" (284) Do you know they were already thinking of this as researchers (285): "The teacher was able to do an interview!" So, with everything we said, they were always pulling something from scientific initiation (286); it was a milestone (287). We had the presentation of papers here last week, and they wanted to present it again. I hung up the banners, and they said, "So we'll introduce? Let's introduce a teacher; let's introduce ourselves!!" (288) So, I saw it is already present in their lives (289). If you continue the work, if there in the state one day you have this dynamic, they will ... You will like it! (290) And How was something (a knowledge) that built step by step (by them). Do not forget T! (291) They were researching, we were ... I would go, I would sit with each group explaining. They read, so it was something they built, and I think they will never forget it! (292).

As was observed for teacher T1, T2 also presents many speeches related to reflections, perceptions, and actions related to learning (column 3) and teaching (column 2), even more predominantly than observed in T1. Only one speech of T2 was characterized in column 1 as being related to content: specifically, in sector 1A of Table 4, the epistemic relation to content. Most interview fragments focus on the sectors (2A) and (3A) of Table 3, characterizing the epistemic relationship to teaching and learning, demonstrating a reflexive movement of the act of teaching and perceptions and reflections about the learning of students. A smaller number of interview fragments are observed in the (2B), (3B), and (3C) sectors of the matrix, being the relationship of the personal to teaching, the personal to learning, and the social to learning. No fragment was allocated to sectors (1B), (1C), or (2C), that is, the relationship of the personal to content, social to content, and social to teaching.

Table 4. Allocation of the narrative excerpts of Professor T2 in the Teacher's Matrix sectors.

New tasks of the teacher **Relationship of teacher** **Relationships with knowledge**	**1** **Management of the T-K segment** **Content**	**2** **Management of the T-S segment** **Teaching**	**3** **Management of the E-S segment** **Learning**	
A **Epistemic**	**1 A** 249	**2 A** 197, 198, 199, 200, 204, 205, 211, 212, 213, 220, 221, 225, 227, 228, 229, 232, 233, 234, 235, 236, 238, 242, 243, 245, 246, 248, 251, 252,254, 255, 257, 259, 261, 267, 268, 269, 270, 272, 273	**3 A** 203, 208, 209, 210, 214, 215, 216, 217, 218, 219, 222, 224, 226, 230, 231, 244, 253, 256, 258, 271, 276, 278, 280, 281, 282, 283, 284, 285, 286, 289,291	74,70%
B **Personal**	**1B**	**2B** 201, 202, 206, 237, 240, 279.	**3B** 223, 239, 241, 260, 262, 264, 265, 274, 275, 277, 287, 288, 290	20%
C **Social**	**1C** .	**2C**	**3C** 247, 250, 258, 263, 266.	5,30%
	1,05%	47,30%	51,65%	100%

Final Considerations

In this work, we present an instrument to analyze the reflections, perceptions, and actions of teachers in the classroom. We consider as a starting point that the classroom is a didactic system (didactic-pedagogical triangle), that is, an open system, in contact with society, consisting essentially of the teacher, the students, and the knowledge. Relationships must be maintained among them to produce teaching and learning (Author2, Author1, & Author3, 2011). The didactic system or didactic-pedagogical triangle can be considered a system of relations to knowledge in a classroom, which involves the teacher (T), students (S), and knowledge or content (K). We re-interpret classroom management and content management as relationship management, and the didactic system can be understood to be a system of relations to knowledge in a standard classroom, where S is the "student group," K is the "knowledge to be taught," and T represents the "teacher." From Charlot, the relations of knowing would be of three types: the epistemic relation to teaching knowledge (disciplinary, pedagogic, and didactic), which would be more related to the processes of understanding; the personal relation, which would have more to do with feelings and the formation of a sense of this knowledge for the teacher; and the social relation, associated with the fact that the teacher is immersed in a community of educators (elementary school teachers, university professors, researchers, administrators, etc.), as well as parents and students.

These ideas were then synthesized and schematically structured in the Teacher Matrix indicated in Table 2. We then applied research in science teaching. The instrument was used in the organization and date interpreted from interviews with teachers working in elementary education on the development of activities based on research teaching in a continuing teacher training program. As a result, we obtained a profile of each of the interviewed teachers and characteristic movements, identifying aspects of their reflections and perceptions regarding content, teaching, and learning, as well as the epistemic, personal, and social relations associated with managing the relationship to knowledge in the classroom.

The obtained results indicated that the reflections and perceptions of the interviewed teachers showed their concern with students' learning during the development of the activities and their teaching and actions as teachers. Finally, it is possible that Table 2 can be used as an instrument for diagnosis and planning in teacher education and in teacher planning in the classroom.

Acknowledgements or Notes

The research project is funded by the CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil).

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