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PEDAGOGICAL MEDIATION OF CHEMISTRY TEACHERS: CONTRIBUTIONS TO TEACHER AND STUDENT TRAINING

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Abstract: Investigations of teachers' pedagogical mediation can help to understand their conceptions of mediation and practices, enabling ways to improve teaching/learning in Chemistry. This investigation intended to know the conceptions of high school and higher education chemistry teachers in Iturama-MG about mediation and their teaching practices. The starting point was the study of the different meanings that the word mediation assumes in literature and in teachers' daily lives. The qualitative research used electronic questionnaires sent to public school teachers: data were transcribed, categorized and analyzed in order to know the teachers' conceptions of mediation and their practices. The mediation of students' learning carried out by the teacher is implicit in their professional skills, so we sought to contribute to the theoretical and practical advances on the importance of mediation and how teaching processes can be improved to improve learning in Chemistry.
Keywords: mediation; teacher training; teaching and learning; pedagogical practices; student training.

OBJECTIVES

The mediation of student learning carried out by the teacher in the classroom environment is implicit in the professional skills of teachers (Tomazello, 2011). The study's hypothesis proposes that investigations of teachers' pedagogical mediation can help to understand their conceptions of mediation and teaching practices, making it possible to seek ways to improve teaching and learning in Chemistry. Thus, this work constitutes an investigation that intended to know the conceptions of chemistry teachers of Secondary and Higher Education in the region of Iturama-MG about mediation and its practices, considering the contributions of the University-School collaborative partnership for the pedagogical practice. teachers in training and active.

THEORETICAL FRAMEWORK

The teacher's role is paramount in the quality of education for children, young people and adults who attend schools: they are responsible for teaching, and that is what is expected of them. Despite this, some teachers still believe that student success is the result of dedication to studies and family structure, not believing much in teaching "theories": what counts, according to them, is practice - problems are always learning, never teaching.

In relation to indiscipline and lack of interest on the part of students that prevails in Natural Sciences classes, in general, teachers attribute these problems to the fact that there is practically no failure in Basic Education anymore: the loss of authority of the teacher who considers having one more repressive system to keep the student under control. It is necessary to contribute to the formation of a professional who is aware of his social role and who is highly qualified, showing different skills in the area of knowledge in which he works, integrating academic knowledge with professional practice, in addition to developing skills such as autonomy (teaching to learn for being able to learn to teach), dealing with diversity, improving investigative practices and designing and executing teaching projects, teamwork, flexibility and cultural enrichment, as defined in the National Curriculum Guidelines, tonic of the experience developed by Brienza, Rogado, Ruggiero, Schnetzler and Tomazello (2007).

The mediation of student learning carried out by the teacher in a classroom environment is implicit in the professional skills of teachers, so there is a need to know, initially, their conceptions on the subject, that is, the way in which the teacher conceives his role of mediator in the process of appropriation of concepts by the student. This is the concept

of "mediation", initially understood as the interrelationship between the teacher, the students and what is intended to be taught through language, action and the various teaching resources available (VERDI; ROGADO, 2011).

Verdi and Rogado (2011), point out that Romanelli (1996) insists on the urgency of promoting changes in science teaching, as the possibilities of pedagogical innovations are conditioned both to the explanation by the teacher of his conceptions about his mediating role in the construction process of the knowledge regarding their understanding of the subject-student interaction dynamics with concepts that demand a high degree of abstraction, as is the case of teaching Chemistry.

Fontana (2000, p.11), based on Vygotsky and Bakhtin, reaffirms the mediated nature of Cognition, highlighting the importance that Vygotsky gave to the presence of the other: "the action of the subjects on the object is socially mediated, by the other and by the signs. The ground is that the man who knows does not know directly. Bernard Charlot states that education is the production of oneself by oneself, but only possible through the mediation of the other. (TOMMASIELLO et. al, 2012).

According to Verdi and Rogado (2011), Gonçalves (2005) clarifies that mediation became the synthesis of the teacher's work, highlighted as a counterpoint in the criticism of the traditional school, in which the role of the teacher was based on the "transmission of contents", and to the new school that reserved a secondary role for the teacher compared to the "doing it for oneself" on the part of the student. Thus, mediation works as an external auxiliary element, which articulates the internal psychic functions to stimuli from the outside world. Language – the most important system for man, according to Vygotsky – is a system of signs. Through it, man comes into contact with the world and its representations. This implies that the child's development is mediated by cultural determinations.

> In this approach, the subject must be understood in the context of social relations, because according to Vygotski (1989), the man-environment integration is mediated by systems of (external) instruments and (internal) signs. By appropriating these cultural systems, man transforms himself, giving rise to ways of thinking and acting that are characteristic of human beings. Thus, in the historical-cultural perspective, the teacher cannot be considered a mere intermediary link between knowledge and the student, a negotiator who, in principle, would remain the same after the negotiation. (TUNNES et al, 2005). (FRANZOL; TOMMASIELLO, 2011).

According to Tomazello (2011), the mediation of student learning carried out by the teacher in the classroom environment is implicit in the professional skills of teachers, however it is little known and investigated in the classroom:

> In Portugal, LOPES et al. (2006) found that existing research on mediation is generally piecemeal and fragmented in nature. In addition, in Portugal, there is a lack of studies in a natural classroom environment, a fact that we believe is also repeated in Brazil, in particular, due to the short time that postgraduate students (considering that the research focuses on courses postgraduate courses) have for the completion of the dissertation, which may prevent the carrying out of broader ethnographic research. In the doctorate, despite the longer time, in general, working conditions are also not favorable to research of this type. The problem is alleviated when there is a team of teachers and advisees researching the same theme, which facilitates the exchange of results, bibliography and analyzes (...) The teacher's mediation, as a central and holistic activity, is not a well-known subject because it is complex in nature and also because

there is little research centered on the classroom (LOPES et al, 2008 apud LOPES, 2009, p.150).

METHODOLOGICAL PATH

The word mediation assumes different meanings, meanings, synonyms. There are at least ten synonyms of mediation for two meanings of the word mediation: intermediation between two people or parties - intermediation, intermediary, arbitration, intervention, intercession, interference, interposition, third, conciliation -; intermediation between buyer and seller - brokerage. Feminine noun, mediation refers (meaning) to the "act or effect of mediating" and "act of serving as an intermediary between people or groups; intervention, intermediary" (DSO, 2020).

The procedures were guided from the studies and protocols constructed by Franzol and Tommasiello (2011), Verdi and Rogado (2011) and Tommasiello and colleagues (2012), being a qualitative research, rich in descriptive data, with a open plan and flexible and focusing on reality in a complex and contextualized way (LÜDKE; ANDRÉ,1986).

The investigation, based on a vigorous bibliographical review, made use of semi-structured questionnaires, applied to Chemistry teachers from public institutions in the municipality of Iturama-MG

The path taken to arrive at the concept of mediation had as its starting point the study of the different meanings that the word mediation assumes in the literature and in the daily lives of teachers in various areas, especially in the area of Chemistry in the region of the municipality of Iturama-MG.

The professors were informed about the research and its objectives, according to the Free and Informed Consent Term - TCLE, approved by CEP/UFTM. Those who voluntarily agreed to participate received a Google Forms form by email, guaranteeing the participant's anonymity and spontaneous participation, as constructed by Franzol and Tommasiello (2011), adapted.

Teachers who wished to participate answered the questionnaire and sent the form, anonymously, which asked:

1. For you, what is mediation?

2. How do you do it in your work?

3. Give an example of one (or more) situation you experienced in the classroom in which you acted as a gauge of student(s) learning.

4. Is there anything you would like to add about the mediation process?

The anonymous responses were then read, transcribed, categorized and analyzed to learn about the teachers' conceptions of mediation.

The categories of analysis were defined a "posteriori" because they were elaborated after the analysis of the material (BARDIN, 1995), taking into account the theoretical framework and the research objectives, opting for categories based on those defined by Gonçalves (2005), as shown in Table 1:

In a second moment, the teachers were once again invited to answer a new, expanded questionnaire, with the aim of deepening their knowledge of their mediation concepts. Again, they were informed that they were free not to participate in the research. The questionnaires were made available and collected in the same way as carried out in the first moment. For this new moment, the questions sought to contemplate conceptions about learning, the teacher's role in the learning process and their mediating competence. The questionnaire used is an adaptation of the one formulated by Franzol and Tommasiello (2011) and Verdi and Rogado (2011), which is based on Giugno (2002) on teacher mediation in the classroom:

1) Conceptions about learning

a) How do you think students learn?

Teacher Mediation Categories	**Description**
Bridge between common sense and science	Mediation as the task of the teacher who places himself in the relationship between subjects, objects and the world, acting as a "bridge", as a "link between common sense and science"; instigating curiosity, stimulating research, questioning in order to arrive at the construction of knowledge.
Facilitator of the construction of new knowledge	The teacher, in the role of mediator, must take into consideration, the "individuality of each child", serving as an "enabler", "problematizer", creating meaningful situations for the construction of new knowledge. In this case, the teacher would be "an active facilitator who instigates and leads the student to reflect and think critically".
knowledge transmitter	The mediation of the transmission of the traditional school: to mediate is "to lead the student to scientific knowledge". This idea may have its origin in the fact that the concept of transmission also supposes "being between" or interposed between two things.
conflict conciliator	"Make a deal"; "composition between conflicting parties"; "dispute arbitration in a neutral manner by law for agreements"; "mobilization of the parties to solve conflicts", "pacification, conciliation". Being between conflicting parties, seeking conciliation and solution. Speeches formulated close to the legal area.
Methodology of your pedagogical practice	"Works by projects"; "participation"; "way of intervening", "raising hypotheses"; or even with the teacher's behavior in the methodology: "problematizing"; "dialogue"; "to involve"; "to question"; "to talk"; "intervene to bring reality". In some opinions, mediation is confused with relationships, or interactions, specifically between student and teacher or between all subjects of pedagogical practice.

Table 1 - Categories based on Gonçalves (2005).

Sample	**Formation**	**Time of Magisterium**	**Level of Expertise**
P1	Graduation	15 years	High School and Higher
P2	Licenciatura	00	Higher education
P3	Bachelor degree	11 years	Higher education
P4	Chemical	10 years	Higher education
P5	Graduation	25 years	Elementary and high school
P6	Graduation	06 years	High school
P7	Chemical	08 years	High school
P8	Graduation	02 years	High school
P9	Graduation	15 years	High School and Technical
P10	Graduation	11 years	Elementary and high school
P11	Graduation	02 years	Elementary and high school
P12	Chemical	21 years	Elementary and high school
P13	Graduation	12 years	Elementary and high school
P14	Graduation	16 years	High School and Higher

Table 2- Characterization of the participants.

Categories Found	Characterization
Teacher mediation as a bridge between common sense and science.	"... it is a process of intermediation between the student and knowledge (...) discussion between knowledge and students". P1 "... it's when the teacher deals with the relationship between knowledge and students (...) my knowledge with that of my students". P6
Mediation of the teacher as a facilitator of the construction of new knowledge.	"... mediation as the teaching activity to help students build their own knowledge, encouraging them to have an active attitude in their training". P3 "... it is when the teacher positions himself as a facilitator, encourager or motivator of learning, which helps the student to reach their goals". P4 "... the teacher acts as a facilitator in the teaching-learning process, contributing to the students' critical sense, becoming the protagonist of their learning". P5 "... an intermediary between people or groups and help guide the student in the act of thinking". P7 "... discussion, questioning until resolution (...) Stimulate interest (sic) induce thinking (...) motivating facilitator with high energy so that the learner reaches their goals". P9 "...facilitate the understanding of a certain subject (...) seek the best understanding for the student, whatever the topic addressed (...) analyze what the student goes through, what problems he is facing, difficulties and even attention (...) that he often doesn't have at home". P10
Teacher mediation as a conciliator of conflicts.	"Follow-up of procedures, promoting the conduction of dialogues, helping in a neutral and impartial way in decision-making". P2
Mediation of the teacher as a transmitter of knowledge.	"... connect the student and their knowledge to the knowledge of (sic) already described in chemistry (...) explain the content (sic) of chemistry, in order to complement their knowledge (...) I corrected and explained the content (sic) that he already had" P8

Table 3- Categorization of teaching conceptions about Mediation.

Sample	Characterization
P11	Learning is mainly based on everyday concepts and the establishment of parallels with the reality experienced by students. In this context, it understands the teacher's role as a mediator in order to encourage students to participate and exchange ideas and plan teaching activities based on these experiences. He has a short career and appears to be motivated, seeking to base his pedagogical practice on theoretical references and placing the student in the central role of learning, but his evaluation is still done using traditional methods.
P12	He does not adopt reflection on his work as a practice in his day to day. He reveals that he does not have any theorist to guide his work, basically based on empirical knowledge about teaching practice. He experienced the scrapping process and devaluation of Basic Education, contributing to the demotivation regarding the development of pedagogical work. Although it demonstrates recognition of the teacher's role as a mediator, the concept of mediation seems to be linked to leading the student to the expected answers: it applies logical reasoning, but does not value the process of building knowledge based on problematization, orientation and organization of contents and establishing relationships with other subjects.
P13	He understands the role of the mediator teacher more clearly, giving indications that it is a practice adopted in his day to day in the classroom to problematize situations, stimulate opinions and direct knowledge by systematizing knowledge to promote learning: the knowledge is built when the contents make sense in the student's life and does not believe that good performance in traditional evaluation methods (tests) reflect learning, but values participation and argumentation based on theoretical references, encouraging critical thinking, which is aligns with Vygostky's concept of zone of proximal development, in which the potential development of the student is verified, his ability to build his own knowledge with the help of the teacher. It seems to be able to detach itself from a rigid curriculum to present the contents in a more integrated way with the daily life of the students, including a theoretical basis for its practice.
P14	It understands that learning occurs from the construction of knowledge acquired in the student's social environment and in the teacher's role in choosing procedures to mediate existing knowledge and that which the student needs to achieve, that the evaluation of learning can take place in different ways. different from the traditional test and highlights the importance of the teacher in the learning process, citing as important elements the organization of classes and the diversification of planned pedagogical practices. Although he does not follow a particular theorist, he cites several authors and this reflects his concern to base his practice on consolidated studies. He demonstrates his anguish with remote teaching due to the lack of contact with the student, since he uses Youtube as a tool, as this medium does not allow for dialogue and effective participation, harming the evaluation of prior knowledge, the exchange of ideas, the visual communication, etc., which can influence the adoption of different evaluation methods.

Table 4- Teacher mediation in the classroom

b) How do you know that the student learned?

c) What factors do you consider important in learning?

d) In your opinion, what is the origin of learning difficulties?

2) Role of the teacher

a) What is the importance of the teacher with the student in the learning process?

b) What attitudes, postures, must the teacher have to help the student in learning?

c) What are the strategies you use for the student to learn? How do you choose them?

d) Is there any theorist that supports your work? If so, what aspects of this theory do you consider relevant?

e) What do you understand by mediation? Which teacher action do you consider most important in mediation?

3) Teaching mediating competence

a) Is it part of your pedagogical practice to get students involved in classroom proposals? If the answer is yes, how do you make that happen?

b) Is it relevant to share with the student the importance of the content being worked on and the intentions/objectives? Is it possible to perform this sharing?

c) Is it customary, in your classroom work, to encourage the student to make connections between the subject in evidence, with content already seen or with future subjects? For example, if you do this often.

d) In classroom work, do you interpret, together with the student, the successful steps in the execution of a task?

e) Is the practice of accepting original responses and encouraging independent thinking part of your way of being a teacher? Exemplify through classroom situations.

f) In your work with students, do you establish clear purposes in relation to learning in general?

g) When the student is faced with new, difficult and challenging situations, what attitude do you take?

h) Do you ask questions to students providing opportunities for self-assessment? In what situations?

The investigation took place in accordance with the "Minas Consciente" protocols due to the expanding pandemic in 2020 and 2021, as well as the use of available technology to carry out remote activities, considering that most activities took place electronically and archived electronic, thus enabling the development of the research.

RESULTS

The investigated sample consisted of forty-three invitations sent and ten responses returned – first questionnaire – and twenty-seven invitations sent and four responses returned – second questionnaire. The results of the questionnaires are described in Tables 2, 3 and 4.

FINAL CONSIDERATIONS

The main results indicate that most of the consulted professors have a conception of mediation limited to the student-teacher relationship: 60% see mediation as a facilitator of the construction of new knowledge and 20% as a bridge between common sense and science, approaching the meaning of "being in the middle of the relationship between subject and object", however, without characterizing "being between what, doing what and for what", approaching the results and observations of Tommasiello and colleagues (2012) and Gonçalves (2005).

Considering the subject as a being who relates with the world, with other beings and with culture, through physical and symbolic instruments, the development of superior psychological functions - abstraction,

attention, conscience, language, memory, perception, reasoning – needs to value the teacher-student relationship in these training and development processes. However, this does not seem to be clear to teachers, even to teachers who train teachers, with little reference to the students' preconceived background of knowledge, as well as the importance of constituting a theoretical background for the understanding and development of their practice. It would be enough for the students to "pay attention" to the classes and for the teacher to contextualize his teaching. Thus, acting as a mediator boils down to facilitating learning, contextualizing, clarifying doubts, motivating and respecting students, in short, an elementary, basic understanding of mediation is revealed – teacher as facilitator, as a "bridge" between knowledge and student.

It is essential that teacher training courses contribute significantly to the integration, without hierarchy, of technical-scientific knowledge (disciplinary; chemistry), general educational knowledge and specific professional training (chemistry teaching; science teaching), considering that teacher training is permanent, in fact, there is a real possibility of a permanent and shared training of teachers between the University and the School of Basic Education, which would certainly enable "quality leaps" and gains in teacher and student training at these institutions.

The works and proposals of the Nucleus of Education in Sciences, Diversity and Environmental Practices, NEduC, on the Iturama campus, at ``Universidade Federal do Triângulo Mineiro``, are guided by this idea, with a view to the permanent training of teachers and that, for this, there is a need to be willing to study, dialogue, overcome innatist conceptions related to "gift" and "a teacher is born made", agreeing with the view of Tommasiello and colleagues (2012)

This work contributed to the understanding of the importance of mediation, signaling that understanding the teaching conceptions and relating them to their practices make it possible to understand them, in view of the transformation of teaching and learning in Chemistry, with repercussions on the pedagogical practices of teacher trainers, teachers working in Basic Education and Higher Education and teachers in initial training. It is suggested future research that articulates interviews with the responding professors who are available to monitor actions in the classroom, in view of the theoretical and practical advances on the importance of mediation and the improvement of teaching processes, improving learning in Chemistry.

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