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JOINT CONSTRUCTION OF PRACTICES AS A CURRICULUM COMPONENT BY EDUCATORS OF TRAINING CHEMISTRY TEACHERS: AN ANALYSIS BASED ON THE THEORY OF COMMUNICATIVE ACTING

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ABSTRACT:

This article presents part of the results of a masters degree research that is related with a theme little explored in science teaching, it is, the joint planning among teacher educators in undergraduate courses. The objective is to analyze the joint constructions of practices and conceptions among teachers educators who teach the disciplines of practices as a curricular component when they are in planning situation of these disciplines with other teachers. Based on the theoretical references of Jürgen Habermas' Theory of Communicative Act and its readers in education and science education areas, it was possible to analyze the interactions among the teachers in the process of joint planning and understand how the process of joint constructions of elements of teaching took place both in terms of actions and conceptions. Beyond, we discuss the ways to make the continuous education of teachers educators at the university.

Keywords:

Joint Planning Group;
Chemistry Teachers
Course; Theory of
Communicative Act;
Practice as a Curriculum
Component.

CONSTRUÇÃO CONJUNTA DE PRÁTICAS COMO COMPONENTE CURRICULAR POR DOCENTES FORMADORES DE PROFESSORES DE QUÍMICA: UMA ANÁLISE A PARTIR DA TEORIA DO AGIR COMUNICATIVO

RESUMO:

Apresenta-se neste artigo os resultados de uma pesquisa que trata de um tema ainda pouco explorado no ensino de ciências, a saber, as possibilidades e os empecilhos do planejamento conjunto entre docentes formadores nos cursos de licenciatura. Tem-se por objetivo analisar as construções conjuntas de ações e concepções entre docentes formadores que ministram as disciplinas relacionadas às Práticas como Componente Curricular quando em situação de planejamento conjunto dessas disciplinas. Com base nos elementos teóricos advindos da Teoria do Agir Comunicativo, de Jürgen Habermas, e de seus interpretadores nas áreas de Educação e Ensino de Ciências, foi possível analisar as interações entre docentes em processo de planejamento conjunto e compreender como se deu o processo de construções conjuntas de elementos das PCC tanto no plano das ações quanto das concepções, além de refletir sobre os caminhos para a formação continuada de docentes formadores no âmbito da universidade.

Palavra-chave:

Grupos de Planejamento
Conjunto; Licenciatura
em Química; Teoria do
Agir Comunicativo;
Prática como
Componente Curricular

LA CONSTRUCCIÓN EN CONJUNTO DE PRÁCTICAS COMO COMPONENTE CURRICULAR POR LOS DOCENTES FORMADORES DE PROFESORES DE QUÍMICA: UN ANÁLISIS A PARTIR DE LA TEORÍA DE LA ACCIÓN COMUNICATIVA

RESUMEN:

En este artículo se presentan los resultados de una investigación que aborda un tema poco explorado en la enseñanza de las ciencias, es decir, las posibilidades y los obstáculos de la planificación conjunta entre los docentes formadores en los cursos de formación de profesores. El objetivo es analizar las construcciones en conjunto de las acciones y concepciones entre los docentes formadores que imparten las materias relativas a las Prácticas como Componente Curricular cuando se encuentran en situación de planificación conjunta de las clases. Basándose en los elementos teóricos que vienen de la Teoría de la Acción Comunicativa, de Jürgen Habermas, y de sus interpretadores en las áreas de la Educación y Enseñanza de las Ciencias, fue posible analizar las interacciones entre los docentes en proceso de planificación conjunta y comprender cómo ocurrió el proceso de construcciones conjuntas de los elementos de las PCC tanto en el plano de las acciones como de las concepciones, además de reflexionar sobre los caminos para la formación continua de los docentes formadores en el ámbito de la universidad.

Palabras clave:

Grupos de Planificación Conjunta; Formación de Profesores de la Química; Teoría de la Acción Comunicativa; Práctica como Componente Curricular.

INTRODUCTION: THE NEED FOR JOINT PLANNING AMONG TRAINING TEACHERS' EDUCATORS ON PRACTICES AS A CURRICULUM COMPONENT

This article exposes and discusses the results of an investigation that sought to understand a topic that is still incipient in the texts of the specialized literature that deal with initial teacher education in undergraduate chemistry courses and on teacher education in general, which are the related issues communication, joint planning and the role of teachers who train teachers in subjects related to teaching in licentiate courses. The questions that guide the argumentation in this work are inserted mainly in the context of the construction process of disciplines related to teaching and the preponderant role of teacher trainers in the realization of Practices as a Curriculum Component (PCC) in undergraduate courses, in this case, in Chemistry.

In this regard, the argument that there is a disconnection between the curricular components in undergraduate courses is often noted, so that each discipline occurs separately and disconnected from the others, as can be seen in the consideration of Kasseboehmer and Farias (2012), when they studied the integration of PCCs in a chemistry degree course.

Finally, it is necessary to discuss an important integration that belongs to the interface disciplines, which was not very recurrent in the disciplines' menus and which can be represented by the topic "Learning theories and the teaching of Chemistry". The sociological and psychological theories that are presented as models for understanding students' learning refer to pedagogical disciplines within the scope of pedagogical knowledge dealt with, for example, by Tardif (2010) and Carvalho and Vianna (cited by Carvalho, 2001). The knowledge related to Education Sciences comprise a body of knowledge that will support the critical reflection of future teachers. However, if the association with the work of teaching Chemistry is not developed and worked with undergraduates, they may not understand the importance of this knowledge for their professional performance. Therefore, it is up to Chemical Education professionals to promote this integration. (p. 119)

The formation of chemistry teacher trainers is debated in researches such as those by Gonçalves, Marques and Delizoicov (2007), Benite, Benite and Echeverría (2010), and Radetzke and Gülüş (2021). In these works, moments of action and reflection by chemistry teacher trainers are discussed and analyzed from the perspective of studying aspects of teaching practice in the undergraduate course that can be understood as moments of training.

The role of teachers in teaching degrees in terms of their role as teacher trainers is discussed by Franco (2009), Silva and Schnetzler (2005), Gonçalves, Marques, and Delizoicov (2007). The latter understand that “in view of this problem, it is necessary to indicate possibilities to favor the professional development of the trainers of the specific content disciplines and the integrative disciplines of the chemistry degree courses.” (p. 04).

Thus, we reflect on the need for integration and partnership between areas of knowledge in teacher education, which, from the perspective of this research, inevitably involves the need for integration among teachers who promote this knowledge in teacher education and the diagnosis that the professors who teach in higher education have planned and executed their classes in degrees in a way that is disconnected from each other and between their contents.

Regarding this need for integration in the training of trainers, Benite, Benite, and Echeverría (2010) state that “the separation of specific professional training from training in content still remains as a practice of initial teacher training.” (p. 284). This issue of planning disciplines in the degree and the interaction between the disciplines that constitute the training process of teachers in these courses was addressed by Silva and Carvalho (2014), Silva and Carvalho (2016), Freitas (2008), and Gonçalves, Marques and Delizoicov (2007) in the field of Science Teaching. According to Silva and Carvalho (2016),

[...] Another reflection of the instrumental foundation of the rationality in current society, specifically in the field of this study, is the practice of disciplines by academics who teach in the licentiate degree and who, for the most part, dedicate themselves to teaching their disciplines without establishing relationships with the teaching issues of this or even other disciplines, a connection that is of fundamental importance in the formation of the future teacher. (Silva and Carvalho, 2016, p. 146).

In other words, among the various points that can be the object of research with regard to science teacher training courses, the problem observed here is the lack of interaction between teachers and the course subjects. In this regard, each professor is responsible for the subject they teach, not having the opportunity to reflect on the importance of the relationship between the contents and the coordinated planning with other professors, nor even to jointly plan training actions aimed at the integration of knowledge in the training of the future teachers.

In this sense, this investigation is presented in the context of research on the formation of trainers, when dealing with teacher trainers who work in disciplines related to PCC in a degree course in Chemistry at a federal public university.

Thus, given the context presented, we seek to propose the development and the analysis of the formation of a Joint Planning Group (JPG) with teacher trainers, in order to understand the following question: What are the possibilities of joint construction on the component elements of the PCC in a JPG with chemistry teacher trainers?

From this question, the research was built with the objective of characterizing the elements of the search for understanding and the joint constructions carried out by teacher trainers in a group of joint planning regarding the PCCs of a degree course in chemistry.

THEORETICAL FOUNDATION: HABERMASIAN THINKING AS A SUBSIDY TO THE UNDERSTANDING OF JOINT CONSTRUCTIONS AND GROUP WORK

The study of joint planning processes between teachers and their training possibilities is still very incipient and there are many theoretical references that can support the understanding of issues related to these processes. To support the problem of this research and analyze the dialogues registered, we have as theoretical references the reflections and research arising from the so-called critical theory, proposed by thinkers who adhere to the Frankfurt School, whose main idea is the disruption of technical-instrumental rationality and the search for rational emancipatory paths for society (PUCCI, 1995; MUHL, 2003).

More specifically, we refer to the discussions undertaken from the understandings of Jürgen Habermas (1929 - current) on the concept of communicative action. A prominent thinker of the third generation of the Frankfurt School, Habermas founded, among others, the ideas of communicative rationality and communicative action, present in this research, and which are represented here in his texts Habermas (2012), Habermas (1986), Habermas (1996), in addition to their interpreters for the issue of education, Mühl (2003), Herman (1999) and Longui (2005).

Habermas' conceptions about the communicative process have been the basis for reflections in the area of education, in which we also rely on here. In a more incipient way, research in the field of science education, such as Chapani (2010), Lopes (2017), Bortoletto (2013), and Oliveira (2016), have been discussing the communicative processes and teacher education based on these reflections. The relevance of the Habermasian foundation of communicative processes for teacher education is highlighted by Lopes (2017) when he argues that:

For this reformulation in the thinking and action of training teachers, we can take into account what is put by Habermas (1989), so that there is no sociocultural way of life that is not, at least, implicitly oriented towards the continuation of communicative action with means argumentative. (p. 04)

Consider that the idea of seeking understanding rethought by Habermas in the context of the concept of communicative action can contribute both to discussing the role of the university and its professors in current models of technical rationality, as well as to support a joint planning process among professors that work in training teachers' courses (Habermas, 2012; Longui, 2005; Mühl, 2003).

The defense of joint planning processes is based on the fact that, for Habermas (1996), language is not a mere resource of thought representation, but a universe of the possibility of understandings, which involve the understanding of speech acts of subjects and the search for understanding based on the strength of the best argument (Habermas, 1996, 2012; MÜHL, 2003). That is, to be considered rational, people need to interact intersubjectively through the use of language. In this scenario of speech acts, an important concept pointed out by Habermas is the "coordination of actions" (Habermas, 2012) according to which:

The need to act in coordination generates a certain demand for communication in society; and this demand must be met when, in order to fulfill the purpose of satisfying this need, an effective coordination of actions is necessarily possible (Habermas, 2012, p. 477).

In terms of communicative actions, speech acts must be conducted in a way to ensure understanding. The way in which subjects in communication make use of language, then, is part of the understanding process, constituting their "illocutionary force" (Habermas, 1996) in the effectuation of understanding.

The understanding here is seen as "a process of unification between subjects able to speak and act" (Habermas, 2012, p. 497) and not as a simple agreement or common agreement between subjects. It starts from a broader context, as social actors can reach a common understanding of the validity claims of all after a rational thematization, as expressed by the author:

Processes of understanding aim at a common agreement that satisfies the conditions for a rationally motivated assent to the content of an exteriorization. A common agreement aimed at communication has a rational foundation since neither party can ever impose it: neither instrumentally, through immediate intervention in the situation of action, nor strategically, through calculating influence over an opponent's decision. (Habermas, 2012, p. 498)

In these terms, the coordination of actions, as a concept, contemplates those moments of an argumentative debate, in which a speaker constantly proposes to reorganize the interpretations that are being built by the group, uses language to re-establish the search for understanding, and demonstrates constant sincerity claims as to your intention of understanding. These characteristics are essential in the construction of communicative action, as defended by the author.

From this perspective, one of the answers to these questions has been that communicative rationality is not embodied in a process of mutual understanding based on validity claims unless speaker and listener understand each other (want to understand) about something in the world in a performative attitude - geared towards second people. (Habermas, 2012, p.112)

In addition, it is important to highlight the relevance of the concept of validity claims, since they are “recognizable speech acts accessible to rational analysis” (Habermas, 1996, p. 25), that is, they can be considered a validity claim when a speaker proposes a certain discussion that should be analyzed by the group through arguments.

Validity claims are those assertions of speakers that are placed in open discussion and intentionally carry the intention that the group will debate them and seek understanding about them. These validity claims have different characteristics and functions that will be validated and questioned by the listeners, being classified into four types (Habermas 2012, p. 85). Are they,

Descriptive: verification of facts, which can be affirmed or denied under the aspect of the truth of a proposition; **Normative (or mandatory):** justification of actions, under the aspect of correcting a way of acting; **Evaluative (or value judgments):** valuation of something, in terms of the adequacy of evaluative standards, of what is good; **Explanatory:** clarify operations such as speaking, classifying, calculating, deducing, judging, from the standpoint of understandability or good formulation of symbolic expressions. [authors' highlights]

With this foundation, together with the elements that give illocutionary force to speech acts - presented in the methodology - what is carried out in this research is a systematic study of communicative interactions that occur in an environment dedicated to debate and joint planning (JPG) between teacher trainers of chemistry teachers during the re-elaboration of the disciplines of chemistry teaching practice.

METHODOLOGICAL REFERRALS

The research undertaken is qualitative and descriptive, as we seek to explore the different situations and social relationships that occur in a specific environment (Cervo *et al*, 2007). Furthermore, it is characterized as participatory research, since the researcher is a participant in the researched group, as an active subject of the research (Brandão, 1999). Four teacher trainers who teach disciplines called Teaching Practice and/or Instrumentation for Chemistry Teaching participated in the researched practice, in addition to the researcher.

Due to the ethical secrecy of the figure of the participants, they are named P1, P2, P3, and P4. As this is a participant-research, it is also important to present the profile of the researcher, who will be named PS. Below, in Box 1, the profile of each research subject is presented.

Box 1. Profile of Research Subjects

Participant¹	Initial Formation	University admission	Subjects taught in the Chemistry Training Course
P1	Bachelor's Degree in Pharmacy and Degree in Chemistry, Master's and Ph.D. in Chemistry with an emphasis on Teaching Chemistry.	July, 2013	Teaching Practice III (curriculum, curriculum documents, textbooks); Teaching Practice IV (interdisciplinary projects); Instrumentation for Teaching Chemistry II (scientific dissemination, non-formal and formal education); Research in Science Education (Research in Education); Internship I and II (observation internships).
P2	Graduation in Chemical Engineering with pedagogical complementation, specialization in Education, Master in Education, and Ph.D. in Industrial Biotechnology.	September, 2010	Teaching Practice I (models and modeling); Teaching Practice II; Instrumentation for Teaching Chemistry I; Internship III and IV (practical internship).
P3	Bachelor's Degree in Chemistry and Master's Degree in Science Education.	March, 2018	Teaching Practice III (curriculum, curriculum documents, textbooks); Internship III (practical internship); Experimental Chemistry.
P4	Degree in Chemistry, Master, and Doctorate in Science Education.	August, 2018	Supervised Internship
OS	Graduation in Chemistry, Degree in Pedagogy, and Master's student in Science Education.	-	-

Source: Prepared by the authors

As the research objectives involved the discussion of subjects related to PCC, the professors who taught these subjects were selected as research subjects. The collection of information was carried out in two stages, the first consisting of an initial individual interview and the second by the performance of the JPG effectively. The information from the initial invitation conversation was obtained through interviews, as this technique allows “to collect descriptive data from the subject itself, allowing the investigator to intuitively develop an idea about how the subjects interpret aspects of the world” (BOGDAN and BIKLEN, 1994, p. 134).

The interviews were used in order to present the research proposal to the professors, to promote an initial reflection on PCC in the chemistry degree course, in addition to knowing their conceptions about the research topic, their involvement, and their vision of the Chemistry course, providing necessary subsidies for discussions to be raised in the JPG. An interview script was used as a guide for discussing questions related to the topic in question. At the end of the interviews, the professors were invited to participate in the JPG at a convenient time and place for all participants.

The main objective of the JPG, clarified to the teacher trainers during the interviews, was to discuss the curriculum and ways of relating the subjects linked to the PCC in the course and to jointly plan the restructuring of these subjects if this was forwarded by the group. Thus, the JPG would be constituted as a collective workgroup on the contents and forms of integration between the PCCs in the course.

In total, there were four meetings lasting 1.5 hours each, as shown in Box 2. Data referring to joint planning meetings were obtained through audio recordings of all meetings.

Box 2. Description of the Meetings – JPG

	Date	Agenda
1st Meeting	29/08/2018	<ul style="list-style-type: none"> - Resume the objectives of the JPG and explain the topics that will be covered in the next meetings; - Comment on the analysis of the interviews; - Term of Consent: signature of teachers.
2nd Meeting	19/09/2018	<ul style="list-style-type: none"> - Teaching Practice I; - Teaching Practice II.
3rd Meeting	03/10/2018	<ul style="list-style-type: none"> - Teaching Practice III; - Teaching Practice IV.
4th Meeting	24/10/2018	<ul style="list-style-type: none"> - Instrumentation for Teaching Chemistry I; - Instrumentation for Teaching Chemistry II.

Source: Prepared by the authors

All meetings were recorded in audio and fully transcribed for further analysis. This procedure is also related to the theoretical and methodological framework used, which is substantially based on linguistic interactions and communicative use of language among the participants. Thus, audio recording is the most effective way of recording data for this research as we seek to analyze the communicative process.

As this work is based on Habermasian references on the communicative use of language in the construction of understandings and as we seek to understand how the communicative process between teachers in the context of a JPG can influence the joint construction of conceptions and practices regarding PCC in the course degree in chemistry, it is of fundamental importance that the methodological procedures for analyzing communicative interactions are consistent with the premises of the framework.

Thus, it is observed that the premises on which Habermas supports his conception of communication demand an adequate reading of the data obtained. Therefore, in this work, data analysis was performed using an analysis device² (Silva and Carvalho, 2016; Silva and Carvalho, 2017) based on the characteristics of the communicative use of language. This analysis device, which basically consists of a sequence of steps for a Habermasian foundation analysis of linguistic interactions in planning groups, is based on the characteristics of language theorized by our framework and is dedicated to finding the elements of language use that confer to this the capacity for communicative action. According to its proponents,

The main contribution of this analysis methodology lies in the differentiation of semantic and pragmatic elements, or propositional and pragmatic contents in the analysis of linguistic interactions, since, in a Habermasian perspective, these two elements make up the linguistic manifestations of the speakers. There is also an attempt to undertake a global analysis, in which the semantic and pragmatic elements are pointed out together, being then highlighted as occurrences of each episode and making the analysis more sequential, as all analyzes are presented following the event of group meetings. (Silva and Carvalho, 2017, p. 255)

Thus, this sequence of steps for analysis is based on the Habermasian idea that speech acts carry an “illocutionary force” (Habermas, 1996; 2002), which contemplates the potential of the use that the speakers make of language to promote the understanding. According to this device of analysis, from the Habermasian perspective, there are characteristics of speech acts that give them a “strength to promote understanding” (Habermas, 1996). These characteristics are attributed throughout the Habermasian framework on the communicative use of language and include elements such as “use of explanatory sentences”, “explicit sincerity claims”, “types of validity claims”, “by intelligibility”, among others expressed in Silva and Carvalho (2017)

An initial analysis was based on the characteristics attributed to the trainer teachers. From the analysis

of the characteristics, it was possible to build a script to take place in the JPG, which does not consist in the process of seeking understanding during the communicative action in the group. Therefore, we take into account some theoretical elements, constituting the following steps:

1. **Identification of analysis episodes:** It consists of the first stage of the analysis, through the transcription of the interviews. It is characterized by a set of speech elements that contemplate a discussion on a certain topic, whether it is of large or small extension.
2. **Identification of speech acts:** each episode during the analysis seeks to identify and select the speech acts, which are characterized by linguistic emissions of propositional or illocutionary content.
3. **Pragmatic characterization of speech acts:** It is the main step in the analysis process. This is where the illocutionary components of these speech acts will be synthesized and named, based on the characteristics of the illocutionary force. Later, they will be characterized according to their type, linguistic meaning, illocutionary force, search for intelligibility, speech characteristics, among others. It is at this moment that we can relate the Habermasian framework to the analysis carried out.
4. **Categorization of joint constructions:** it would be the synthesis of propositional and pragmatic characteristics (exposed in a scheme), which are divided into two plans, action plan, and concept plan, where the first shows the proposed action planned and executed by the group, these being the results of the understanding of their needs, and the second represents the understanding reached by the intersubjective interaction, characterized by the process of seeking understanding.

For the effective analysis of the data, these steps were followed, so that the excerpts from the interactions, characterized as speech acts, were classified according to the characteristics of the communicative action. As an example, we present, in Box 3, an excerpt from the analysis.

Box 3. Example of an analytical framework based on the analysis device

Speech Act	Characteristics
Researcher: So, the next question is what is the importance of teaching practices in teacher education, and all teachers agree that it is essential for good teacher education. So, P2 says that a good teacher has to know chemistry, and from there, it is discussed how best to teach chemistry. On the other hand, P3 says that the two things go hand in hand, the specific subjects with teaching practices, the way I'm going to work the content in the classroom, the relationship between specific subjects, and this is all brought up in teaching practices. And P1 says that, based on the practices, the student can better relate the specific content with how to teach certain content and a phrase that I found interesting: "We don't give ready-made models, but we create the teacher's creative mind based on fundamentals." So, I would like us to discuss a little about this issue of specific disciplines and disciplines of teaching practice if you think...	Truth Claim
	Action coordination
P3: what P1 said about ready-made models, I remember as a student, which was one of the biggest criticisms of the students, because they want to know how to teach, how I teach such things and that doesn't exist, there's no such recipe. We give instruments, show strategies so that they can get to know each other, and each one will check the best way to teach a certain content.	Normative Validity Claim

Source: Prepared by the authors, adapted from (Silva and Carvalho, 2017)

Thus, these excerpts were characterized according to the characteristics of the communicative use of language - illocutionary force - eliminated in the analysis device followed. Following these methodological steps, it was possible to understand the communicative process that took place at the JPG with teacher trainers who work in the chemistry degree, as well as the joint constructions in the plan of actions and conceptions undertaken by these trainers from the analysis of the communicative characteristics of the undertaken debates.

JOINT CONSTRUCTIONS ON PCC BY TRAINING TEACHERS AT JPG: DATA ANALYSIS AND INTERPRETATION

We present the data and results obtained during the implementation of this work. We called data the elements of intersubjective interaction and speech acts are analyzed from the perspective of the theoretical framework. The analysis is divided into two parts, the first of which seeks to analyze the initial interviews carried out with the trainers, and the second part is the analysis of the communicative process introduced during the meetings in the JPG, verifying the validity claims raised, the semantic characteristics and pragmatics of speech acts, elements of the search for understanding, relationships between lifeworld and system, action plan and joint constructions.

We emphasize that the data will be presented in a partial way, representing the general results. All interactions between trainers were analyzed from the perspective of the analysis device – Box 2 – and the data are summarized in this article so that they are representative of the general results.

In the analysis of the initial interviews, it was possible to show that the professors perceive that there are issues in the chemistry degree course that are not yet well established and that need to be re-elaborated and modified. In other words, based on the interview questions, it was possible to concatenate the common thematic concerns among the teachers so that they could meet and jointly re-elaborate the PCC of the degree course in question.

Box 4, for example, concatenates the syntheses of the professors' answers regarding the question *"In your opinion, does the set of subjects in the Institution's Chemistry Degree course include everything that a future teacher must know to teach in high school?"*. The intersections of common thematic concerns among the interviewed trainers are shaded in equal colors. The numbers presented in the first column of the frames are a codification of the lines of these frames so that it is possible to refer to the content of these lines in a more specific way throughout the text; the elements highlighted in the same color represent common thematic concerns among the interviewed trainers.

**Box 4. Synthesizing elements and convergences of the initial interviews
(thematic concerns) from Question #4**

	Professor #1	Professor #2	Professor #3
4.1	We work on the major themes of Science Teaching in Teaching Practices	We work Art and Science in teaching, but I don't know if we do it in the best way	
4.2	Yes, there are contents that need to be changed and others that need to be updated in practices	I don't know of other content that needs to be changed, I need to think about it more calmly	Yes, there are things that need to be changed
4.3	We do not work the content of the History of Chemistry in teaching, for example	We don't work History of Chemistry	Because it is an area that interest me, I miss History of Chemistry contents in the course
4.4		STS approaches I also think they have to stay and be improved	

Source: Prepared by the authors

It is noted, in the intersection of the syntheses of the professors' speeches, that the three were forceful in stating that the set of subjects offered in the Chemistry Degree course does not yet fully contemplate what a future teacher must know to teach in High School and point out the need for content related to the history of chemistry to be inserted at some point in the course, as this is a formative gap for undergraduates.

Box 4 exemplifies the process that was carried out for all questions in the initial interview. This procedure of understanding and intersection of thematic concerns was repeated for all questions from the initial

interviews and resulted in the general synthesis of the thematic concerns of the trainers after all the initial interviews, presented in Box 5.

The importance of common syntheses of initial interviews in this process is related to the need to constitute a common interest of the group members is important in the construction of sincerity claims (HABERMAS, 2012) and are called thematic concerns by Kemmis and McTaggard (1988). Interpreting this idea, Silva and Carvalho (2016) understand thematic concerns as “the set of themes or problems with which teachers expressed greater implicit or explicit interest in getting involved due to principles, conceptions, and experiences that lead them to become interested in these thematic. (p. 158).

Box 5. Common thematic concerns among the interviewed professors

5.1	It is necessary to work on issues related to the History of Chemistry
5.2	Teaching practices are essential in the training of chemistry teachers and need to be constantly updated
5.3	Chemistry teaching practices need to be more integrated into specific chemistry disciplines
5.4	Specific chemistry knowledge is essential in teacher education
5.5	There is the possibility of discussing the issues raised in a group designed for this purpose.

Source: Prepared by the authors

With the initial interviews, it was possible to observe a scenario of common thematic concerns about the organization of chemistry teaching disciplines (line 5.2), about the need for updating the course regarding the teaching of chemistry (line 5.1), about the importance of the relationship between the specific disciplines and the disciplines of teaching practice (line 5.2 and 5.4), and, mainly, to conclude on the need for greater interaction between the teacher trainers (line 5.5).

It is also important to highlight that the thematic concerns arising from these initial interviews represent teacher education issues that have been highlighted by research in the area. Massena and Monteiro (2011) and Lima, Ibraim, and Santos (2021) already point, respectively, to the importance of the formative relationship between disciplines with specific content and teaching, and the need for historical and epistemological knowledge in the training of teachers of chemistry. In this sense, what should be pointed out here is the fact that the points of attention found by all the trainers separately are these key points of teacher education, which allowed the JPG, when gathered, to focus primarily on the discussion of these themes.

In this sequence, the episodes of analysis of the first meeting are exposed, in which we seek to characterize the most representative manifestations of the characteristics of the implementation process of inter-subjectively mediated communication (HABERMAS, 2012) and analyze the process of joint constructions and the characteristics of the communicative use of language. Meeting 1 is presented with the details of the analysis process, in order to understand the analytical exercise, and then the general results of each meeting.

The first meeting began with an explanation by the researcher responsible for the research about criteria and justifications for the occurrence of this work, highlighting the importance of the contributions of the professors, in addition to characterizing the researcher's role as a member of the group, so that she can also contribute to the restructuring of the course menu, systematizing the points discussed in the meetings. This moment is expressed in PJ's speech:

PJ: *One thing that **can be a counterpart**, not that there has to be a counterpart, but that can arise, with my help, of course, is the fact that chemistry is also in the process of rebuilding the CPP³ and **the Researcher is committed to gather all the ideas and proposals and deliver them ready for you to take to the SFN**,⁴ and I speak on our behalf as I am also a member of the board and participate in the SFN, so we do not*

need to focus on this work of putting ideas and proposals on the paper for improving the disciplines, she can commit to delivering this to us so that we take it to the SFN as a ready proposal, so she offers it as a counterpart, which is to systematize proposals for improvements, changes in the curriculum, innovations that can be placed in teaching practices. [authors' highlights]

Note that the PJ makes the research criteria clear, by reminding the professors what the objectives of the work and meetings are. Thus, we can classify this speech act as a **claim of sincerity**. Still, this speech act brings with it a **claim of truth**, as it makes clear the possibility of shared use of the joint constructions developed there.

This introductory but necessary speech was carried out to represent a moment of building confidence in what is being proposed in the group, as the pretensions of truth and sincerity must be explicit, in order to promote the characterization of the debate situation as such, as argued Habermas (1996):

The speaker must commit, that is, indicate that in certain circumstances, the consequences of the action will be taken for granted. The type of obligation determines the content of the commitment, from which the degree of sincerity can be identified. This condition, presented by Searle as the 'sincerity rule', must always be satisfied in the case of actions aimed at gaining understanding (p. 92)

In addition, the initial expression is characterized as an **Claim of Normative Validity**, as it takes into account aspects not only of the world of life but also of the system, when dealing with the SFN as an instance to be consulted on the proposals elaborated in the JPG.

The episode #2 presents a discussion about the best way to insert a new subject into the course curriculum, with the participation of all JPG members. Next, the linguistic interactions between the subjects of the group were analyzed as proposed in the research methodology and are presented in Box 6.

Box 6. Discussions raised in the JPG

	Speech Act	Characteristics
6.1	Researcher: So, the first questions I put in box form. So, initially, there are more general questions and I won't focus too much on that, but just for P4 to know, the first question is related to the training of each of the teachers and it is interesting to note that initially, teachers P1 and P2 were not graduated with a degree in chemistry, P1 has a degree in pharmacy and P2 in chemical engineering.	Search for Intelligibility
6.2	<p>Researcher: So, the three teachers said no, there are still points in the curriculum that need to be improved and we are not working on the history of science and the history of chemistry. And you also said that you don't know if you contemplate everything you need to know.</p> <p>Researcher: So, I would like us to make our discussion based on the common points that you spoke about in the interview, mainly, for example, about the history of science.</p> <p>Do you agree that a history of science/chemistry course is missing from the chemistry degree course? Do you see a way to improve this, with this theme being in the undergraduate chemistry course?</p>	Claim of Sincerity
		Search for Intelligibility
6.3	<p>P2: So, with the arrival of P4, we see that it is now possible for us to contemplate the history of chemistry/science with better quality. The history of chemistry even we were never technical, but questions of the historiography of science I tried to work with, so we already talked and he suggested other texts besides the ones I was already using, so this issue is already structuring at this moment, for from here on 2 weeks this was already being qualified on the course.</p>	Claim of Truth
		Normative Validity Claim
		Claim of Sincerity
		Action Coordinator
6.4	Researcher: And do you think about doing this in the form of a discipline?	Action Coordinator
6.5	P1: Firstly in the form of discipline.	Systemic Imperative
6.6	Q3: In the form of a specific discipline?	Search for Intelligibility
6.7	P2: Yes, that would replace the discipline "Introduction to Entrepreneurship" (ADM083).	Consideration of systemic imperatives
6.8	Researcher: P1, why don't you agree with this change?	Action Coordinator
6.9	<p>P1: No, I agree... I agree. I agree with the insertion, so, what will it be like is that we are still discussing, or is it already discussed, right P2? It will be in place of ADM083, not that I have a preference for ADM083, but our question is: would it make a small adjustment to the current grid and this was a proposal I took last week at the collegiate meeting, but P2 has an even more audacious proposal for restructuring the course itself, in order to expand, in terms of time and workload, and in this, we managed to do, as it will change, we could make some substitutions of some subjects that for the students has been not very productive in terms of training for them and, on the other hand, we have other training needs that are not being addressed, so we can make this move and then the suggestion of P2, if we are really able to implement this change in the grid, in the grid, no, it is a new grid with a longer period of time, keeping more or less the same subjects but with some changes and then the suggestion is to replace Entrepreneurship with a subject within this theme (history of science).</p>	Consideration of systemic imperatives
		Normative Validity Claim
		Use of explanatory phrase

Source: Prepared by the author

From the analysis carried out in Box 6, it is noted that, firstly, the researcher searches through claims of truth and sincerity, demonstrating the importance of discussing the subject in question for the group, as expressed in lines 6.1 and 6.2. Furthermore, in lines 6.2 and 6.3, one can see the researcher's truth acting as coordinator of actions, as it seeks to bring as a synthesis of the concerns for the validation of the group and to re-present the themes for discussion as intentions of actions. This position of action coordination is very important in the construction of understandings, as Rasco (1998) argues:

Therefore, when understanding the validity requirements, discursive communication becomes an area of argumentative freedom, in which participants, freed from external and internal constraints (without threats and violence and without ideological deformations) can freely express, justify and problematize their opinions, their norms of action and those of others, in one, as McCarthy (1978p, 306) calls, "symmetrical distribution of opportunities". (p. 77, our translation)

Thus, we have P2 bringing a proposal to what was asked by the researcher, when referring to P4 and the fact that it is a specialist in the area for which there was a delay in the course, forwarding a proposal for action regarding the thematic concern pointed out in line 5.1 of Box 5. However, it is possible to observe that the way in which the discipline of the history of chemistry will be conducted is not yet a consensus among all the professors in the group, since P2 says that this will be conducted as a discipline, however, P3 questions her, asking if it would be a specific discipline, which is answered positively by teacher 2. Here, a **search for intelligibility** is undertaken.

Next, it is interesting to portray the moment of perception of the systemic imperative, a characteristic that is very present in discussions between trainers, as P1, as the course coordinator, brings to the discussion characteristics of norms, legislation, and system impositions, which are expressed in line 6.9. This occurrence is not related to a value judgment about the presence of **systemic imperatives** in the discussion about the organization of a discipline, but to pointing out the different moments in which this demand crosses the discussions, as it is part of the process already described by Habermas, in which the values of the system irretrievably permeate the elements of the world of life.

When the system becomes independent of the lifeworld and more complex, the dynamics of influence between the two changes. From the initial situation, in which the world of life determines the systemic structure, with the social complexity, roles are inverted and the system starts to govern the world of life. (Mühl, 2003, p. 1039)

From this analysis, we built the first synthesis of joint constructions, as shown in Box 7. These syntheses are necessary so that there is a monitoring of the joint constructions undertaken throughout the planning process.

Box 7. First Synthesis of the Joint Constructions of the first meeting

	The researcher presents the thematic concerns of the group for debate
7.1	Discussion about the relevance of the current disciplines of the course and the possibility of creating a new one
7.2	First attempts at a systemic organization of the curricular structure to implement the new discipline

Source: Prepared by the authors

Thus, the first meeting was basically constituted by claims of normative and explanatory validity, which is close to what is expected, since it deals with the initial presentations of how all members see the problems presented by the researcher, who acts there, purposefully, as a provocateur of the discussion. During the follow-up of the analysis of the subsequent meetings, the elements of communicative use of language were changing, so that the uses of claims of normative and evaluative validity became more expressive, in addition to a greater recurrence of the use of explanatory phrases and searches by intelligibility.

This process of searching for characteristics that confer illocutionary force to speech acts in interactions between members of the JPG was carried out for all meetings, and all consensuses that were reached

from elements of communicative action were listed as part of the joint constructions. The result of this step is explained in the synthesis of the joint constructions presented in Box 8 and in the synthesis of the illocutionary elements presented in Box 9, which present, respectively, the final grouping of the syntheses of the joint constructions and the illocutionary elements of the language of each of the meetings.

Box 8. Synthesis of joint constructions produced in the JPG, by meeting

Meeting#1	
8.1. Discussion about the relevance of the current PCC disciplines of the course	8.2. First attempts at the systemic organization of the curricular structure to implement the new discipline
8.3. Normative aspects that qualify the formation of a future chemistry teacher.	8.4. Discussion about the organization of the discipline History of Chemistry.
8.5. Discussions on the restructuring of Curricular Internships regarding their legal aspects.	8.6. Joint Constructions on the Curricular Internship discipline.
Meeting #2	
8.7. Discussions about restructuring the disciplines' curricula Teaching Practice I and II.	8.8. Discussions on the removal of aspects related to the history of chemistry from Teaching Practices I and II.
8.9. Insertion of aspects related to language cognition	8.10. Hypotheses about the large dropout of students from the course
8.11. Sharing activities that delight students	8.12. Insertion of aspects related to chemical reactions
8.13. Removal of the topic "epistemological obstacles" from the Practice III curriculum	
Meeting #3	
8.14. Discussions on restructuring Teaching Practice III and IV curricula.	8.15. Withdrawal from the document analysis activity of these disciplines
8.16. Discussions about the importance of working concepts related to designations with undergraduate chemistry students	8.17. Imposition of the systemic imperative - universal education system
8.18. Insertion of experimentation in teaching chemistry	8.19. Importance of problematizing experimental practices
8.20. Complete Restructuring of Teaching Practice IV.	8.21. Interdisciplinary classes based on project pedagogy
Meeting #4	
8.22. Complete restructuring of the Teaching Structure and Functioning I and II	8.23. Importance of thinking about special needs students in teaching chemistry
8.24. Survey of the profile of graduates for a reconstruction of teaching practices	

Source: Prepared by the authors

Box 9. Synthesis of illocutionary elements produced in the JPG, by meeting

Meeting #1	Meeting #2
9.1. Claim of Truth	9.2. Explanatory validation claim
9.3. Claim of normative validity	9.4. Claim of evaluative validity
9.5. Claim of Sincerity	9.6. Action coordination
9.7. Search for intelligibility	9.8. Claim of Sincerity
9.9. Understanding of systemic imperatives	
Meeting #3	Meeting #4
9.10. Action coordination	9.11. Claim of evaluative validity
9.12. Use of explanatory phrases	9.13. Explanatory validation claim
9.14. Understanding of systemic imperatives	9.15. Action coordination
9.16. Claim of Truth	9.17. Use of explanatory phrases
9.18. Explanatory validation claim	

Source: Prepared by the authors

From Boxs 8 and 9, which present the results found in the general scope of the research, it can be understood that the joint constructions carried out by the group teachers took a specificity from the subjects that were being studied in each meeting. While the first manifestations of mutual understanding arising from the communicative action are related to principles that the disciplines must contain and conceptions about the role of the disciplines, throughout the meetings, actions, and conceptions about the role of each discipline in the general formation of the graduates.

It can be noted, for example, in Meeting 2 (8.7, 8.8, 8.8, 8.13), a significant restructuring in the topics of the syllabuses of two of the teaching practice disciplines, with the removal of topics from the curricula and discussion of new topics to concatenate these teaching practice disciplines with the need for course updating. We emphasize that these joint constructions represent those decisions/consensus/assertions that were mutually agreed upon between the professors so that they are the result of a communicative debate.

Thus, the very existence of these understandings about the needs of the CCPs in the course is the result of the possibility of a space for joint planning, since “the communicative and intersubjective language is regulated from the point of view of those who make the claims, aiming at educational transformations and formative. (MELO, 2020, p. 82).

The point to be highlighted in the general scope is the researcher’s role as coordinator of actions, that is, the fact that the coordination of actions was exercised mostly by the researcher and is more present throughout the meetings. This fact is very important since the coordination of actions is part of the constitution of joint constructions because, among other interpretations, it means that the group starts to trust the researcher as an enabling figure to implement the group’s ideas. Habermas (1996), when describing the relevance of coordination of actions as an element of illocutionary force of speech acts, describes,

Communicative action can, thus, be distinguished from strategic action in the following aspect: the successful coordination of actions is not based on the purposeful rationality of the respective specific action plans, but on the rationally motivating power of fulfilling the effects of obtaining understandings, that is, in a rationality that manifests itself in the conditions for a rationally motivated agreement (p. 111)

In other words, the predominant occurrence of action coordination can be interpreted as a communicative action referral, which allows characterizing many of the joint constructions as the result of communicative action in the group. In another comparative understanding, Box 10 presents the compilation of the general joint constructions undertaken by the JPG in the action plan and in the concept plan. Thus, it is possible to visualize what the JPG effectively built together with regard to the actions to be implemented in the PCC and the conceptions about them.

Box 10. Joint constructions in the action plan and conceptions carried out by the JPG

Action Plan	Concept Plan
The need for a discipline: History of Chemistry	Discussion about the relevance of the current disciplines and the possibility of creating a new one
Restructuring the Course Curriculum	First attempts at a systemic organization of the curricular structure to implement the new discipline
A good chemistry teacher has to know chemistry	Normative aspects that qualify the training process of a future chemistry teacher
Discussions about how the History of Chemistry discipline will be conducted	Discussions on restructuring the Curriculum Internships
During the training of chemistry teachers, we should not offer ready-made learning models	

Source: Prepared by the authors

Observing the organizational charts of the general results (Boxs 8, 9, and 10), it is possible to understand the analysis, and that allows us to make a more consistent reflection on the practice of joint planning among teachers and understand the results in the light of the literature on the topics discussed in this paper.

We emphasize, in our analysis, a relationship between the joint constructions undertaken by the teachers in the JPG and the elements of communicative use of language, as can be seen in the comparison between meetings 1 and 2 with meetings 3 and 4, in Box 9. In this case, the participants are using more explanatory phrases, arguments, and pretensions of evaluative validity, while in the first meetings, in the moments of the constitution of the enabling environment of communicative action, the search for intelligibility and claims of sincerity were more prominent.

This finding points to the possibility that in more permanent JPGs, constituted for a longer time than this case, it is possible to advance more and more in the establishment of an increasingly communicative space for joint planning and construction, as it becomes freer of coercions. This relationship, which occurs here, between the space that enables communicative action and the occurrence of joint constructions between teachers, is also pointed out in the works of Freitas (2008) and Chapani and Carvalho (2010), who develop an understanding of the processes of the search for understanding in science teacher training groups.

The set of joint constructions presented in Box 10 systematizes the group's "achievements", that is, the resolutions, agreements, and achievements that were agreed upon by its members and that were the result of a communicative agreement. The changes in the disciplines' curricula and the creation of a new discipline were agreed as they are part of a very relevant meeting, the joining of thematic concerns with spaces for communicative action, in which common demands are the object of open and intersubjectively mediated discussion. Approximate results of these in studies undertaken in the continuing education of basic education teachers are found in research by Lopes and Carvalho (2018) and Bortoletto (2012).

In order for teacher training to take place focused on responsibility and autonomy in dealing with socio-scientific issues like any other topic, it is essential to seek a balance between the uses of objective, subjective and social reasons. It is based on this balance that it is possible to develop communicative practice among teachers aimed at understanding. (Lopes and Carvalho, 2018, p. 160)

However, the researches dedicated to promoting and evaluating the spaces of communicative action as a means for the continued education of trainers and professors at the university are still very incipient. Based on these analyses, we make considerations about the process, in dialogue with the references in the area.

CONSIDERATIONS AND PERSPECTIVES FOR THE CREATION OF GROUPS OF HIGHER EDUCATION TEACHERS

This work was an opportunity for analysis and reflection on the possibilities arising from the development of a space for communicative action among teachers of the chemistry degree, in which the joint planning processes that took place were analyzed and considering the contexts and needs of the training teachers. In addition to discussing the influences of technical rationality in the organization of university courses, the framework provides categorical elements for understanding the intersubjective communicative process between subjects who communicate.

The relevance of teacher educator training actions in discussion spaces is also posed, as in this research, in the reflections of Silva and Schnetzler (2005), Silva and Schnetzler (2000), Carvalho (2005), and Franco (2009). The first highlights as a result of its investigation the occurrence of a strategy of formation of trainers based on a reflective discussion about their practices, while the latter states that “how do university professors build pedagogical knowledge? He builds them when he ponders the confrontations of theory with practice.” (p.17). Thus, the results of this research join those that point out the effects of setting up discussion groups with teachers who train teachers.

With regard to the construction of communicative processes, it is noted that throughout the trainers’ meetings, the elements of communicative action were used more explicitly, especially the use of explanatory phrases and as explanatory and evaluative validity claims, which denote a referral to the search for understandings.

It was also possible to understand how the process of interaction between the documents and the survey of the characteristics of these interactions took place, noting that when there is a member of the group who proposes to act as coordinator of actions, it is noticeable that a more open debate is forwarded. and free from coercion, enabling joint construction.

This finding is aligned with the results presented by Silva and Carvalho (2016), who precisely point to the role of the Habermasian figure of the coordinator of actions in the constitution of moments of the search for understanding in communicative processes among teachers. Longui (2005) also points to the collective construction of language skills when there is coordinated action, stating that “the analysis of these actions is important because they carry with them elements that indicate communicative action”. (p. 115). Thus, we emphasize the validity of the organization of communication spaces between professors along the lines of the JPG described here by subjects who are familiar with the issues under debate and are in a constant explicit position in the search for understanding.

Regarding the joint constructions, the discussions resulted, at the end of the process, in the planning and implementation of a subject in the history of chemistry, which was initially pointed out by all as a necessity of the course, as well as the restructuring of the subjects of teaching practice and instrumentation for the teaching of chemistry – which are the PCCs in the course -, in order to contemplate inclusions and removals of contents and approaches, aiming at updating these disciplines.

Additionally, the most important thing to point out is that these joint implementations and constructions were accompanied by a change in the elements of communicative use of language. Thus, we can infer the relevance that decisions and structures in undergraduate courses are preferably constructed in the context of joint planning groups, as also pointed out by research such as Camargo et. al (2012), in addition to Silva and Carvalho (2014), who report results of joint planning of disciplines by teacher trainers.

In fact, what the results expressed here allow us to defend is the idea that a conceptual and practical integration between the disciplines that make up the PCC, as well as between the disciplines of undergraduate courses in general, can occur more effectively when its professors the opportunity for discussion, reflection and joint planning of changes in these disciplines, especially when in an environment that enables communicative action, in which the elements of communicative use of language are present in the performance.

However, like all research, there are limitations to be understood. In this sense, it is also important to reflect on how the system has persuaded the form of action of the teacher trainers, since, after the proposals in the joint planning group, some proposals were not improved and implemented. This aspect is related, in the references of this research, with the systemic imperatives, which are constantly colonizers of the world of life. As Mühl argues (2003, p. 39), “while the evolution of the system is measured by the increase in the institutions’ ability to command, the evolutionary assessment of the world of life takes place through the growing autonomy of the spheres of culture, society, and personality.”. Furthermore, these systemic imperatives must be considered as a theme of the communicative debate, so that an understanding of their role in the consecration of the purposes of the world of life can be built (Mühl, 2003; Habermas, 2012).

Therefore, it is important to raise the following question, resulting from the process of this research: What are the systemic limitations for the implementation of training proposals undertaken by teachers together, and how to overcome them?

Finally, we must reflect on the role of JPG training as a training strategy for higher education teachers. Given the interpretation built here that the joining, in groups, of teacher trainers to jointly build the conceptions and actions of training a degree course in chemistry enabled the development of elements of communicative use of language and resulted in some joint constructions, We venture to propose that the work of training teacher educators take place in their places of teaching practice through study and planning groups, with discussions based on elements of their courses, based on their thematic concerns.

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NOTES

- 1 In addition to the subjects presented in Box 1, there was also the participation, in only one meeting, of a professor, named throughout the text as PJ. This one is not specifically constituted as a research subject because he does not teach the PCC disciplines, but he only participated in the first meeting with the duty of explaining the research that was being developed.
- 2 Analysis Device is the name given by the authors of the reference article to an instrument for the analysis of linguistic interactions with a Habermasian approach, as can be seen in Silva e Carvalho (2017).
- 3 Course Pedagogical Project.
- 4 Structuring Faculty Nucleus (SFN) is the instance of the undergraduate course responsible for the pedagogical organization and proposal of changes in the course.

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