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The Training of Mathematics Teachers From the Perspective of Developing the Teaching Competence of Professional Noticing

A Formação de Professores de Matemática na Perspectiva do Desenvolvimento da Competência Docente de Observar com Sentido

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Abstract

This paper is part of a thesis already defended, which aimed to present the results of an investigation about the development aspects of the teaching competence of Professional Noticing. This competence was observed from the point of view of the mathematics lesson planning, using digital technologies in order to point out possible similarities, differences and singularities between two participating groups in initial and continuing education. This research is both qualitative and exploratory, using the case study as the main research strategy. In this context, an educational experiment was implemented, combining math activities with the use of technological resources in primary education. The experiment was divided into five modules, with a workload of 40 hours and the collaboration of 15 participating subjects. In this case, were used the following data collection instruments: *online*, lesson plans and evaluation rubric. Based on the results, an analysis was performed from the perspective of Discursive Textual Analysis and with the help of the *software* IRaMuTeQ. Developmental evidence of the competence of Professional Noticing were also observed in the proposed activities, mainly with regard to the recognition of the potential of using DICT in mathematics teaching.

Keywords: Professional Noticing. Mathematics Teaching. Teaching Competence. Textual Analysis; IRaMuTeQ.

Resumo

O presente artigo é um recorte da dissertação mestrado, já defendida e tem por objetivo apresentar os resultados de uma investigação sobre os aspectos de desenvolvimento da competência docente de Observar com Sentido. A referida competência foi observada sob o ponto de vista de planejamentos de aula de matemática, com a utilização de tecnologias digitais, de modo a pontuar possíveis similaridades, diferenças e singularidades entre dois grupos de participantes, em formação inicial e continuada. A pesquisa caracteriza-se como qualitativa de caráter exploratório, tendo como estratégia de pesquisa o estudo de caso. Nesse contexto, foi implementado um experimento educacional, reunindo atividades de matemática com a utilização de recursos tecnológicos, a nível de ensino básico. O experimento foi dividido em cinco módulos, contou com uma carga horária de 40h e a colaboração de 15 sujeitos participantes. Como instrumentos de coleta de dados foram utilizados: formulários online, planejamentos de aula e rubrica de avaliação. Com base nos resultados, analisados sob a ótica da Análise Textual Discursiva e com o auxílio do software IRaMuTeQ, foram observados indícios do desenvolvimento da competência de Observar com Sentido nas atividades propostas, principalmente no que diz respeito ao reconhecimento das potencialidades da utilização das TDIC no ensino de matemática.

Palavras-chave: Observar com Sentido. Ensino de Matemática. Competência Docente. Análise Textual. IRaMuTeQ.

1 Introduction

There are many authors who have focused their research to understand the development of competencies in mathematics teaching integrated with digital technology resources, as well as to signal the need to discuss their concepts and applications, especially regarding the insertion of digital technologies in the teaching-learning process (Barbosa, & Matempi, 2020).

In this sense, the teaching competence of Professional Noticing is of utmost importance in discussions about identifying, interpreting and making a decision for action, regarding the construction of the student's mathematical thinking. Such competence allows the mathematics teacher to contemplate everyday school situations in a professional way, a condition that distinguishes him from the way other educators from different areas observed the situation.

This research has as its theme the development of the teaching competence of Professional Noticing in the initial and continuing education of mathematics teachers, aiming to instigate the development of a professional look at a pedagogical practice. And as its main objective, to point out signs of the development of that competence by the participating subjects in the research, when they plan and evaluate a class using digital technologies mediated by VLE, through a rubric.

It should be noted that this study presents and discusses the results of the author's master's research. In this sense, the paper was organized in six sections: the first, called Introduction, presenting the subject studied; the second and third sections, DICT and VLE in teaching work, and From the conception of teaching competence to Professional Noticing, respectively, the general concepts of the theoretical framework are presented; in the Methodological Approach Section, the research methodology, data collection and analysis are

highlighted; the fifth Section describes the organization and analysis of the results; and finally, the Conclusion Section presents the final considerations on the study carried out.

2 DICT and VLE in Teaching Work

The term Digital Information and Communication Technologies (DICT) is currently disseminated as an update of ICT (Information and Communication Technologies), which includes, in addition to current and modern technological resources, old ones such as: television, radio, newspaper, etc. Being DICT, commonly used to refer to electronic and technological devices, which include computer, Internet, tablet, smartphone, etc. (Costa, Duqueviz, & Pedroza, 2015). Therefore, the terminologies DICT, digital technologies and technological resources were used interchangeably, when pointing out in this research, certain technologies such as: computer, tablet, cell phone, smartphone or any other device that allows navigation on the Internet and in virtual learning environments.

Over time digital technologies have become indispensable to the modern man's daily life, enabling a new way of communicating, interacting and learning to access information available electronically. DICT provides new educational practices and the development of new scenarios for the teaching-learning process, as well as curricular changes, which imply a change in both teacher and student's attitude, as well as the role played by technology (Borba, 1999). Thus, the new technologies are capable of promoting cognitive changes and an immediate understanding of the available information, and hence potentiate new forms of representations, meanings and knowledge (Zille, 2012).

Regarding teacher training for teaching with technologies, teachers must seek viable alternatives for the benefit of education, making it a personal commitment to their own training, as well as to the benefit of learning and knowledge construction (Perrenoud, 2000).

The use of learning environments in mathematics teaching built with the mediation of technological resources, is able to promote a significant learning of curricular contents, as well as streamline the teaching-learning process, and thus enhances beneficial changes to pedagogical practices and methodologies of teaching (Konflanz et al., 2019).

In this sense, technology information combined with DICT and the *internet* has gained notable relevance for teaching, with regard to the development of Virtual Learning Environments (VLE). VLEs are virtual spaces with technological apparatus, which include media and educational resources, consisting of both the technological aspect and the pedagogical foundation, in which students have access to the proposed materials, allowing quick feedback between learning subjects (Malta, 2019).

Within this frame of reference, it is necessary to discuss teacher training regarding the use of digital technologies and virtual learning environments in the teaching-learning process, promoting the development of critical knowledge and reflective attitudes (Poeta, 2019; (Konflanz et al., 2021). So that teachers in initial and/or continuing education are able to incorporate DICT and contribute to improvement and innovation in education.

3 From the Conception of Teaching Competence to Professional Noticing

The term competence has a polysemous character, having different conceptions and meaning. In one of these is related to teacher training, the topic of the educator's competence which is concerned to the quality of the educational work stands out, becoming essential for the teacher to have a critical view of "why and for what to teach", considering skills and professional qualities in their pedagogical practice, so that the teaching work is competent (Rios, 1997).

Teaching competence can also be understood as the result of a pedagogical practice, developed both in initial training and in the daily life of the profession, in which "the description of competences must start from the analysis of situations, from action, and from this derive knowledge" (Perrenoud, 2000, p.2). In this sense, a competent educational praxis is also consolidated in didactics and diversified methodological conducts, necessary to teach specific concepts expertly (Goulart, 2007).

Bearing in mind that the teacher will develop the ability to understand, criticize and significantly modify the perception of the teaching-learning process, either through the emergence of new ideas or through the insertion of digital technologies in their pedagogical practice, building a more comprehensive view of their teaching activities, as well as their social role as educators (Konflanz & Ferreira, 2022, p. 19).

It is understood that competence then has the character of mobilizing resources, with the intention of solving a classroom situation, resulting in a range of specific skills. That said, its development must be instigated and built with commitment from initial training to everyday school life.

Among the most diverse conceptions of this theme, in particular the teaching competence of Professional Noticing allows the Mathematics teacher to act in the teaching-learning process, integrating the skills of: observing, interpreting and making decisions. Thus, when considering a classroom situation, it is up to the mathematics teacher to: identify relevant aspects of the approach adopted by students when observing the teaching proposal; interpret the learning context and interactions between the subjects involved; make an action decision, connecting the specific situation observed and theories about teaching Mathematics (Sánchez-Matamoros, Fernández, Valls, García, & Llinares, 2012).

From the standpoint of mathematics teacher training, emphasis is placed on the importance of teachers applying specific knowledge, developed both in initial and continuing training, to resolve everyday school situations that arise in their professional activities.

In this sense, the training of mathematics teachers demands that the undergraduate student be prepared to carry out his work competently, and for the teacher to be able to analyze the activity that is intended to be conducted, identifying the knowledge that underlies it. Thus, enabling the identification of the relevant characteristics of the teaching work from the students' understanding, in relation to the answers presented by them (Llinares *et al*., 2019).

Therefore, it is necessary that teacher training programs encourage graduates to use and generate new knowledge as a way of teaching-learning. Being pertinent, reflecting on the way in which prior knowledge is related to the specific knowledge developed in graduation, directly implying the development of the competence of Professional Noticing, understood as of fundamental importance for the teaching-learning process of mathematics (Groenwald & Llinares, 20219; Sánchez-Matamoros, Fernández, Valls, García, & Llinares, 2012).

Therefore, the use of new digital technologies enhance the learning of mathematics, as they allow the design of learning environments which can facilitate the use of activity records as a *feedback*. It constitutes a highly relevant resource for both teachers and students, as it allows for the analysis of doubts, difficulties encountered and learning monitoring of the contents studied.

4 Methodological Approach

Qualitative exploratory research was adopted in this investigation. Since this type of approach, "the research has the environment as a direct source of data. The researcher maintains direct contact with the environment and the object of study in question, requiring more intensive fieldwork" (Prodanov, 2013, p. 70). In order to enable the identification of certain characteristics of the research environment, such as the researcher's direct connection with data, the main focuses of this research approach are the descriptive character in the analysis of the findings, as well as the greater interest in the process and its meanings than in the results (Raupp & Beuren, 2006).

The research strategy focused on case study, which seeks to emphasize the discovery, interpretation, and context of the investigation, in-deep and detailed. Seeking to implement a learning environment that would provide the development of the Professional Noticing competence, based on activities in a remote format, as well as collecting data that could be used in the analysis, an educational experiment was proposed, presented below.

4.1 The educational experiment

A VLE was implemented in this paper with the purpose of studying an educational experiment, which included a 40-hour workload organized into nine meetings with synchronous and asynchronous activities. For this, the learning platform *Google Classroom* hosted activities using digital technologies on mathematics content at the Basic Education level.

The subjects of this research were 15 participants, divided in two groups: The first, consisting of undergraduates from the Mathematics Degree course, scholarship holders from the Institutional Program for Teaching Initiation Scholarships (PIBID) and the Pedagogical Residency, totaling nine participants; The second group was formed by mathematics teachers, in continuing education, from elementary and/or high school of public and private schools in the city of Bagé, Rio Grande do Sul, Brazil, summing up six participants.

The experiment was divided into five modules including activities with digital technologies for teaching mathematics content, named: Module 1 - Geogebra and Gridzzly; Module 2 - Mathspad and Slido; Module 3 - Canva, Prezi, Learning. apps and Sobek; Module 4 - Seppo and Powtoon; Module 5 - Quizalize, Mathingon.org and Phet Colorado; Complementary Materials Module - Tutorials for preparing presentations and gamification on open access platforms, suggestions for didactic sequences and a selection of BNCC skills and abilities for study.

As to the synchronous meetings, the following activities were conducted: presentation of the team who carried out the experiment, the schedule with the actions and the VLE modules; completion of the Informed Consent Form, as provided in Circular Letter No. 2/2021 of UNIPAMPA (CONEP/CNS/MS) in relation to guidelines for research in a virtual environment, with regard to ethics and confidentiality; discussions and studies on the activities developed and made available in the VLE; discussion on skills and abilities described in legal documents, such as the Common National Curricular Base and National Curricular Parameters, as well as the teaching competence of Professional Noticing; planning of two mathematics classes using digital technology resources and later the individual evaluation of the lesson plans, according to the rubric.

In regard of the planning evaluation dynamics, it was consisted of: a group of undergraduates in initial training evaluated the plans developed by its members; while the group of teachers in continuing education evaluated the plans developed their own members. Thus, to maintain fairness in the evaluation dynamics, the plans had the names of the authors replaced by codification "*PLAN*+[number]", indicated in the evaluation rubric. The plans were distributed randomly in at *Google Drive*, in order to avoid evaluators carrying out the activity with their own lesson plans.

In relation to the asynchronous meetings, it was agreed that the workload committed to this would be used to write a reflection about the activities carried out and the technologies discussed, as well as the lesson planning activities and assessments performing, which could be concluded in the meantime.

The instruments for data collection were: online questionnaires (registration form, course evaluation form); recording of the meetings (with the participants consent); the developed lesson plans; rubric for evaluation of plans.

5 Analysis of the Results

The organization and analysis of the results was performed using the Textual Discourse Analysis (TDA) method. The hypotheses described by the TDA refer us to a methodology of qualitative analysis of information with the purpose of producing new understandings about the phenomena and discourses, representing a movement of an interpretative and profound character (Moraes & Galiazzi, 2016). To organize the research data, as well as the analysis of the results, the *software* IRaMuTeQ *corpus* allowed an overview of the processing information and a deepening of the text corpus (Ratinaud, 2012).

IRaMuTeQ enables different forms of textual data analysis: from the simplest, such as basic lexicography, to the

multivariate analysis (descending hierarchical classification (CHD) □ chi-square test and dendogram). Plus, it is possible to perform: analysis of specificities, singularities found in the text; similarity analysis, based on graph theory, using appropriate metrics. Although the literature presents a variety of proximity measures, the Jaccard metric has been chosen. According to Rezende (2011), proximity between documents represented as binary vectors can be assessed using Jaccard metrics. In this research, it was decided to use the Descending Hierarchical Classification (DHC) and Similiarity Analysis resources, for the analysis of planning and evaluations respectively, performing a differentiation of the text corpus into individual classes, to elucidate similarities, differences and singularities of the themes (Ramos, Lima & Rosa, 2018).

The main reason for choosing the IRAMUTEQ (R Interface pour les Analyzes Multidimensionnelles de Textes et de Questionnaires) is due to the fact that it organizes the data into units of meaning of each material analyzed. Thus, a parallel can be easily drawn between the software tools and stages of TDA. a) The corpus textual corresponds to a set of texts composed by lesson plans and evaluation rubrics. b) The dismantling the text (fragmentation and unitarization) allied to the use of the software via statistical analysis. C) CHD and similarity analysis (categorization), clustering textual units from the arrangement of the classes presented, they can be considered intermediate classes from the point of view of TDA. Typical text segments enabling the return to the units of meaning as well as the attribution of a score for each of them. The higher the score the higher the density of the text segment showing its importance within the class.

5.1 Analysis of lesson plans

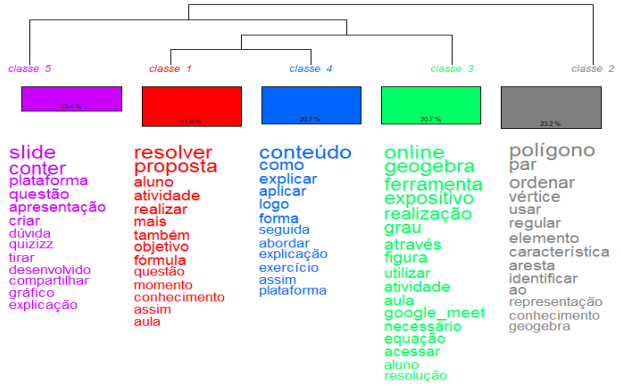
To accomplish the lesson planning, the participants should use the template available in the VLE, and also have the help of the activities performed in the course, the slides of the presentations, the complementary materials and the examples of didactic sequence, with Basic Education content. It should be noted that this activity was carried out on two occasions, in meetings three and eight, as discussed with the participants and provided for in the experiment's schedule of actions.

5.1.1 First planning

This stage had the participation of the 15 participating subjects, guaranteeing their anonymity in their lesson planning through the designation of Plan with sequential numbering: Initial training - PLANO01, PLANO02, …, PLANO09; Continuing training - PLANO10, PLANO11, …, PLANO15.

Initially, the fragmentation of the lesson plans was carried out, in which the parts of the plans that were directed to explain the actions and aspects of the available composition model were observed, with the exception of images, links and texts of statements. A *corpus* , which was analyzed using the "Descending Hierarchical Classification" (DHC) tool in IRaMuTeQ, generating the dendogram shown in Figure 1. Considering that the terms in the figure are in Portuguese, a glossary containing the English language terms was prepared, as shown in Table 1.

Figure 1 - Analysis of the 1st plan



Source: research data.

Table 1 - Glossary of the terms in Figure 1

GLOSSÁRIO / **GLOSSARY**									
slide	**slide**	resolver	**resolve**	conteúdo	**content**	online	**online**	polígono	**polygon**
conter	**contain**	proposta	**proposal**	como	**like**	geogebra	**geogebra**	par	**pair**
plataforma	**platform**	aluno	**student**	explicar	**explain**	ferramenta	**tool**	ordenar	**order**
questão	**question**	atividade	**activity**	aplicar	**apply**	expositivo	**exhibition**	vértice	**vertex**
apresentação	**presentation**	realizar	**realize**	logo	**soon**	realização	**realization**	usar	**use**
criar	**create**	mais	**more**	forma	**form**	grau	**degree**	regular	**regular**
dúvida	**doubt**	também	**also**	seguida	**then**	através	**through**	elemento	**element**
quizizz	**quizizz**	objetivo	**objective**	abordar	**approach**	figura	**figure**	característica	**characteristic**
tirar	**take away**	fórmula	**formula**	explicação	**explanation**	utilizar	**use**	aresta	**edge**
desenvolvido	**developed**	questão	**question**	exercício	**exercise**	atividade	**activity**	identificar	**identify**
compartilhar	**share**	momento	**time**	assim	**so**	aula	**class**	representação	**representation**
gráfico	**chart**	conhecimento	**knowledge**	plataforma	**platform**	google_meet	**google_meet**	conhecimento	**knowledge**
explicação	**explanation**	assim	**so**			necessário	**necessary**	geogebra	**geogebra**
		aula	**class**			equação	**equation**		
						acessar	**access**		
						aluno	**student**		
						resolução	**resolution**		

Source: research data.

At first, five classes are observed, treated from the perspective of "intermediate categories" according to the ATD. Thus, in Class 1, which consists of plans 6, 7 and 9, it was noted that the student is seen as a passive agent in his own learning, since this class refers us to the resolution of exercises and the identification of mathematical formulas, as well as the use of technological resources to support the presentation of content, not focusing on the construction of knowledge based on technology.

On the other hand, Class 4 which is in the same sub-

branch of Class 1, reinforces the attribution to the teacher, the act of "ministering" the content. Consisting of plans 2 and 3, it emphasizes the specific concepts of the discipline, on teaching with traditional practices, where technology receives the support function for the presentation and resolution of exercises.

When considering the terms "GeoGebra", "ferramenta" and "expositivo", present in Class 3, as it is constituted by Plans 10, 11, 14 and 15, it was observed that it follows the same notes as Classes 1 and 4. However, it points out the difference in the use of *software* as a technological resource in class planning, as well as its use in an expositive class context, which allows feedback *for* both students and for teachers with the function of helping students in solving exercises

Class 5 presents digital technology as a tool for exposing content in class, inserted in a remote class context. Being constituted solely by PLANO04, this class proposes the use of Canva and Google Meet tools to present and explain the contents and activities to the students.

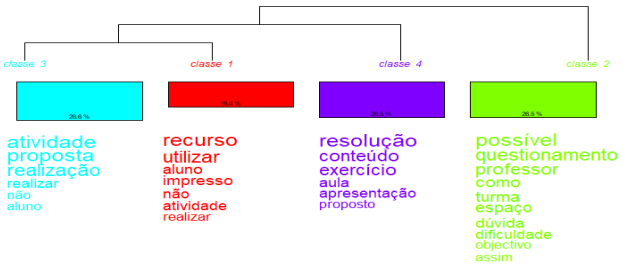
Class 2, on the other hand, it is called by *solitary class* since it does not belong to the same branch as other Classes Analysis. Plus, it is made up of Plans 5, 12 and 13. This class represents the set of pedagogical actions in which the use of technology is justified by providing a representative visual stimulus, in relation to concepts of plane geometry, in which the analyzed plans themselves make it clear that the technological resource can help in the representation of the elements and characteristics of the geometric solids, and in the resolution of exercises.

From this analysis, the proximity between Classes 1, 4, 3 and 5 is consolidated by the use of technological resources as a way to help the presentation of contents and exercises, and the discussion of contents. In turn, Class 2 emphasizes the graphic and visual representation of the content, using digital technology.

5.1.2 Second planning

This activity was conducted by seven participating subjects, four from the group formed by undergraduates in initial training and three from the group consisting of teachers in continuing training. It is noteworthy that all of them also carried out the 1st planning. Following the designation of the previous stage, the lesson plans were coded to replace names of the authors: Initial training - PLANO01, PLANO02, …, PLANO04; Continuing training - PLANO05, PLANO06 and PLANO07. In Figure 2, below is the filogram with the analysis obtained in IraMuTeQ.

Figure 2 - Analysis of the 2nd planning



Source: research data.

Table 2 - Glossary of the terms in Figure 2

GLOSSÁRIO / **GLOSSARY**							
atividade	**activity**	recurso	**resource**	resolução	**resolution**	possível	**possible**
proposta	**proposal**	utilizar	**use**	conteúdo	**content**	questionamento	**questioning**
realização	**realization**	aluno	**student**	exercício	**exercise**	professor	**teacher**
realizar	**realize**	impresso	**printed**	aula	**class**	como	**like**
não	**not**	não	**not**	apresentação	**presentation**	turma	**class**
aluno	**student**	atividade	**activity**	proposto	**proposed**	espaço	**space**
		realizar	**realize**			dúvida	**doubt**
						dificuldade	**difficulty**
						objetivo	**objective**
						assim	**so**

Source: research data.

From the perspective of ATD, in Class 1, which comprises Plans 6 and 7, the attachment to elements of traditional methodologies classes is reinforced, by emphasizing printed material and digital technology, as support for solving problems/exercises. On the other hand, Class 3, which is very similar to the previous one since they are part of the same sub-branch, is constituted only by PLANO03 and corroborates in the paradigm of the insertion of digital resources in support of the expository and traditional class methodology, to improve the understanding of the concepts explored in class.

Class 4 confirms the issue of using DICT to present the concepts studied in class, emphasizing the terms "resolução", "exercício" and "apresentação", for example, a fact identified in PLANO02. It is highlighted here, the proximity of that class to Class 3, however, this emphasizes the "better understanding" of the activity in class mediated by *online*, while in Class 4, digital technology is reinforced in its use for " exposition of the content".

And finally, Class 2, which comprises Plans 1, 4 and 5, corroborates the other classes of analysis about teaching with expository and traditional methodologies. However, these plans highlight a greater sensitivity of the subject participating in the research, in relation to the treatment of possible difficulties and questions, and in comparison, to the other lesson plans developed in the previous stage. In this case, a more thorough analysis was made of the plans that contained the themes: matrices, quadratic function and trigonometry.

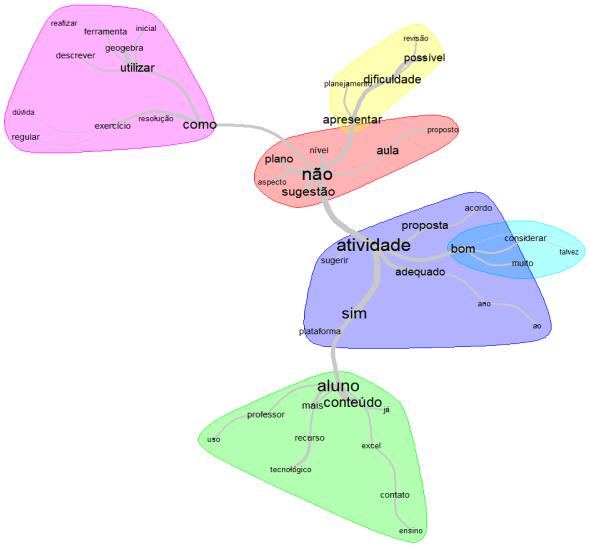
In short, little depth was observed regarding the use of digital technologies and VLE research tools in lesson planning, indicating attachment to the traditional and little knowledge about the potential of using DICT to build mathematical learning. It is noteworthy that in the two stages of planning, there was great willingness on the part of the participating subjects to conduct the proposed activities, considering the quality of the developed lesson plans, the training and experiences of each participant.

5.2 Analysis of the evaluations of the plans

For this stage of the analysis of the results, the *corpus* of analysis consisted of the text, in its entirety, extracted from the evaluations of the developed lesson plans according to an evaluation rubric, in which they were organized into two categories of evaluative aspects: 1- Conceive and manage problem situations; 2- Vision of the objectives, relationship between theory and planned activities. The methodology used was "Similitude Analysis", and the tool was IraMuTeQ, which allows identifying the co-occurrences and the connection between the terms, helping to analyze the meanings of the results structure.

Next, in Figure 3, the analysis is of the Category 1 "Conceiving and managing problem-situations", in which the evaluative aspects and suggestions were organized into six interconnected regions. Two of them are more central and with greater significance, observing three characteristics. At this stage of the analysis, participants were coded as follows: Initial training - FI1, FI2, FI3, …, FI8; Continuing training - FC1, FC2 and FC3.

Figure 3 - Analysis of category 1 of evaluative aspects



Source: research data.

Table 3 - Glossary of the terms in Figure 3

GLOSSÁRIO / **GLOSSARY**							
como	**like**	apresentar	**submit**	acordo	**agreement**	aluno	**student**
descrever	**describe**	aspecto	**aspect**	adequado	**suitable**	contato	**contact**
dúvida	**doubt**	aula	**class**	atividade	**activity**	conteúdo	**content**
exercício	**exercise**	dificuldade	**difficulty**	bom	**good**	ensino	**teaching**
ferramenta	**tool**	não	**not**	considerar	**consider**	excel	**excel**
geogebra	**geogebra**	nível	**level**	muito	**very**	mais	**more**
inicial	**initial**	planejamento	**planning**	plataforma	**platform**	professor	**teacher**
realizar	**realize**	plano	**plan**	proposta	**proposal**	recurso	**resource**
regular	**regular**	possível	**possible**	sugerir	**suggest**	tecnológico	**technological**
resolução	**resolution**	proposto	**proposed**	talvez	**maybe**	uso	**use**
utilizar	**use**	revisão	**review**				
		sugestão	**suggestion**				

Source: research data.

Gathering the regions in red, yellow, and pink in the figure above, the first characteristic was observed, in which the term "no" appears more intensely, indicating that in relation to the lesson plans, no suggestions were presented for the considered aspects. Such characteristic was called "Treatment of methodological actions and difficulties", as it emphasized the pertinence of dealing with possible difficulties during planned practice actions, as well as the methodology used, which was allied with digital technologies. Proposition observed in the speeches: Evaluation - FI4: "[The planning] *does not present alternatives for dealing with possible problems to be faced by the students*"; Suggestion - FI4: "*Analyze the possible doubts of the students to resolve doubts more easily*".

The second characteristic, called "Quality of plans", comprises the regions in purple and cyan. In this case the term "activity", associated with the context of the practice of the pedagogical proposal, is more intense and indicates that the plans were in accordance with the proposed teaching level and execution time, both being considered "good" or "very good", as observed in the statements: Evaluation - FI3: "*The time is in accordance with the planning*", FC3: "*The activity is suitable for the eighth grade*"; Suggestion - FC3: "*This activity can also be adapted to the ninth grade, in the study of the affine function*".

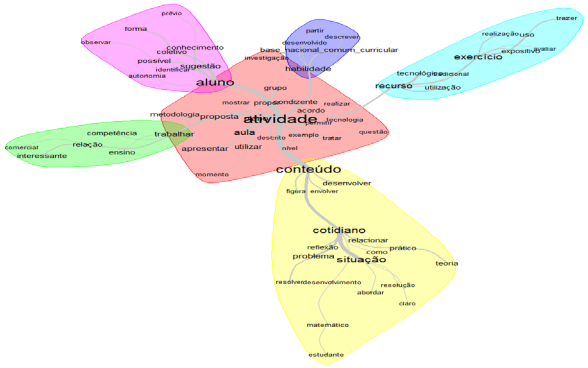
The third, and last characteristic, is designated by the green region in Figure 3, and was called "Protagonism in the teaching-learning process". In this characteristic, the student is emphasized as the focus of the didactic actions proposed in the lesson plans, showing that it should be the protagonist in the teaching-learning process. When observing that the terms "student" and "content" stand out, it is highlighted that the plans should consider the use of DICT more dynamically, so that they are able to involve students with the proposed materials, enhancing the construction of knowledge. Such propositions are observed in: Evaluation - FI5: "*The planning presents the* [...] *tool to apply exercises in the form of a game, but without using it as a central part of the dynamics*"; Suggestion - FI5: "*You could use more digital tools, and try to describe in more detail the proposal with the tool* [...]".

Therefore, certain similarities were pointed out between

the three observed characteristics, such as the proposition seen as positive, in relation to the use of DICT and VLE tools in planning, as well as the contact of digital resources with the teaching of mathematics, although these notes consider this interaction ineffective in planning, since they were evoked as support for teaching with traditional practices.

In relation to the analysis conducted on Category 2, of the evaluative aspects "Vision of objectives, relationship between theory and planned activities, methodology used", as shown in Figure 4, the arguments were organized into six regions, one of which is more central with greater potential for significance, where two main characteristics were scored.

Figure 4 - Analysis of category 2 of evaluative aspects



Source: research data.

Table 4 - Glossary of the terms in Figure 4

GLOSSÁRIO / **GLOSSARY**									
aluno	**student**	acordo	**agreement**	apresentar	**submit**	avaliar	**evaluate**	abordar	**approach**
autonomia	**autonomy**	atividade	**activity**	aula	**class**	comercial	**commercial**	claro	**of course**
BNCC	**BNCC**	condizente	**consistent**	competência	**competence**	conteúdo	**content**	cotidiano	**everyday life**
coletivo	**collective**	grupo	**group**	descrito	**described**	desenvolver	**develop**	desenvolvimento	**development**
conhecimento	**knowledge**	habilidade	**skill**	ensino	**teaching**	exercício	**exercise**	envolver	**engage**
descrever	**describe**	investigação	**research**	exemplo	**example**	expositivo	**exhibition**	estudante	**student**
desenvolvido	**developed**	metodologia	**methodology**	interessante	**interesting**	figura	**figure**	matemático	**mathematician**
forma	**form**	mostrar	**show**	momento	**time**	realização	**realization**	prático	**practical**
identificar	**identify**	permitir	**allow**	nível	**level**	recurso	**resource**	problema	**problem**
observar	**observe**	plano	**plan**	questão	**question**	tecnológico	**technological**	reflexão	**reflection**
partir	**go to**	propor	**propose**	relação	**relationship**	tradicional	**traditional**	relacionar	**link**
possível	**possible**	proposta	**proposal**	trabalhar	**work**	trazer	**bring**	situação	**situation**
prévio	**prior**	realizar	**realize**	tratar	**treat**	uso	**use**	teoria	**theory**
sugestão	**suggestion**	tecnologia	**technology**	utilizar	**use**	utilização	**use**		

Source: research data.

Note that the first feature covers the region in red, at the center of the figure, and those above it. This characteristic was called "Recognition of pedagogical actions", as it refers to the organization of planning, recognizing the pertinence of using digital technologies in line with the diversity of methodological possibilities enhanced by their use in teaching.

In this sense, the terms "methodology" and "proposal", which are linked to the region in green, raise the question of the development of skills linked, in large part, to the interests of the working world. The strong connection with the region in pink emphasizes the proposal of developing students' autonomy, as well as favoring collective work. Observations identified in the speeches: Evaluation - FI1: "Important knowledge and skills directed to the study and the labor market"; FI5: "Students have moments of autonomy"; Suggestion - FI8: "It would be interesting to work in form of mathematical investigation in order to propose more autonomy and criticality to students and also propose tasks and activities, in groups would help the collective work of the students".

In turn, the purple region points out the potential of the development of skills and competencies as described in the BNCC. While the region in cyan recognizes the potential of using digital technologies, even if considered as support for traditional and expository teaching. As observed in the statements: Evaluation - FI8: "Traditional methodology, the use of technological resources is a positive point"; FC3: "Adequate, at the level and skills expected in the BNCC"; Suggestion - FI8: "It would be interesting to put in the lesson plan the specific competencies and skills of the BNCC, in order to show the relationship between the proposed activities and the curriculum"; FI8: "To escape from the more traditional teaching, one could work with more active methodologies. Examples, contextualized problem situations, laboratory activities, workshops, investigative activities, among others".

Finally, the second characteristic was observed in the region in yellow and was named "Relationship of theory with practice". For this, the proximity of the terms "activity" and "content" were considered, and the context, in which it relates the didactic actions of the lesson plans with the specific content studied, the connection with the students' daily lives and the construction of the student's mathematical thinking. Propositions observed in the participants' speeches: Evaluation - FC2: "integrates theory and practice, although it does not appear in the plan the situations where it could be used in everyday life"; Suggestion - FC3: "everyday situations can be addressed during the reflections made by the teacher in the lesson development. You can present the equations through daily problem situations".

Regarding the analysis of the results, a considerable similarity was observed between initial and continuing education, about the evaluation of the planning, reflecting indications of the development of the competence of Professional Noticing. The use of DICT, which in a large part of the lesson plans was designated with a focus on the presentation and resolution of exercises, was highlighted in the evaluations from a perspective of evolving the teaching-

learning process of mathematics, as Perrenoud (2000) and D'Ambrósio (1996) indicate.

6 Conclusion

Based on the results analysis, it was observed a certain fragility in relation to the development of lesson plans, even considering the activities and discussions held in the meetings about the use of resources of the learning environment. As well as the DICTs served largely as support for teaching with traditional practices, in which a certain resistance to break this paradigm is observed.

Regarding the evaluations of the planning, the recognition of the skills and competencies developed in mathematics teaching is emphasized in line with the BNCC. Although, sometimes cited as a technicist teaching, which prioritizes the technique in the pedagogical praxis.

It is stressed that signs of the development of Professional Noticing competence were observed in the activities built on the implemented educational experiment. In this sense, one can point out when considering the critical and aesthetic aspects of the teaching work, there was adequate treatment of the methodological actions and possible difficulties, as well as recognition of the quality and creativity of the planning, and the leading role of the student in the learning process. Also, the characterization of pedagogical actions and the relationship between theory and practice were considered essential in pedagogical praxis, according to the ethical and technical dimensions of teaching competence (Rios, 1997; Rios 2002).

That way, we point out the similarities, differences and singularities between the groups of participant subjects: I) Similarities - fragile conceptual and methodological detailing in lesson plans; recognition of skills and competences for the teaching of mathematics; use of DICT as a support to traditional teaching; II) Differences - engagement and participation of teachers, more effective in synchronous meetings; while the undergraduates had more dedication in the asynchronous activities, planning and evaluation; III) Singularities - the undergraduates demonstrated a more theoretical and conceptual view on the theme; while the professional experience of the teachers prevailed, due to their experiences in the classroom.

Although all research objectives have been met regarding the limitations of the study, it should be noted that: the critical period of the Covid-19 pandemic, which made face-to-face meetings unfeasible; as well as, at the request of the participating subjects, the synchronous moments had their time reduced, for better use of planning and evaluation activities. It is concluded this research can contribute to studies in the field of Mathematics Teaching regarding the use of digital resources as tools to enhance the teaching-learning process and the significant construction of mathematical knowledge.

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