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## The Mathematics Curriculum of the School Learning Management Program

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### O Currículo de Matemática do Programa Gestão da Aprendizagem Escolar

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#### Abstract

This article is part of a master's thesis and aims to analyze the contents of the Gestar I Program constituted by the General Guide, Notebooks on Psycho-pedagogy, Theory and Practice (TP) and Learning Support Activities (LSA), aimed at the continuing education of teachers of the Early Years, from 2001 to 2004, with emphasis on the subject of Mathematics, in the North, Northeast and Center-West regions. The methodological approach focuses on the Cultural-Historical strand and points out traces of the practices of the Program that are based on the skills and competencies oriented by the National Mathematics Curricular Parameter, intoning intrinsic actions of the discipline getting rid of memorization practices, using the mathematical language, symbols and representations that join the thought of the construction of learning with emphasis on the student's social practice, use of didactic resources and significant strategies organized by the teacher that can be appropriated by the students.

**Keywords:** Continuing Education; Mathematics Teaching; Gestar I.

#### Resumo

Este artigo é parte da dissertação de mestrado e objetiva analisar os conteúdos do Programa Gestar I constituídos pelo Guia Geral, Cadernos de Psicopedagogia, Teoria e Prática (TP) e Atividades de Apoio à Aprendizagem (LSA), destinados à formação continuada de professores dos Anos Iniciais, no período de 2001 a 2004, com ênfase na disciplina de Matemática, nas regiões Norte, Nordeste e Centro-Oeste. A abordagem metodológica centra-se na vertente Histórico-Cultural e apontam vestígios das práticas do Programa que se baseiam nas habilidades e competências orientadas pelo Parâmetro Curricular Nacional de Matemática, entoando ações intrínsecas da disciplina desfazendo-se de práticas de memorização, utilizando a linguagem matemática, símbolos e representações que se unem ao pensamento da construção da aprendizagem com ênfase na prática social do aluno, uso de recursos didáticos e estratégias significativas organizadas pelo professor que possam ser apropriadas pelos alunos.

**Palavras-chave:** Formação continuada; Ensino de Matemática; Gestar I.

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## Introduction

This article is part of a master's thesis and aims to present the analysis undertaken on mathematics content during the continuing education of teachers in the School Learning Management Program (Gestar I), from 2001 to 2004, in the North, Northeast and Center-West regions.

In view of the changes established by the Brazilian Constitution (1988), education is conceived as a right of Brazilian citizens and changes the pedagogical work to be developed in the school environment. From 1988 on, the school assumes the responsibility for guaranteeing the students' learning (right to learn), and the educational institutions and teachers have the duty to teach. Another inheritance was the implementation of Public Policies that outline the construction of the path to teacher training, the constitution of professional knowledge, the development of teaching materials and instruments needed to improve the teaching and learning process.

In 1997, the National Education Plan (NEP) was approved, establishing achievable goals based on access, permanence and improvement of the quality of education. In the same year, the National Curricular Parameters (NCPs) were created with the purpose of being a quality reference for the Elementary School education in the whole country.

In this sense, the NCPs already presented a proposal aimed at recognizing how primordial the student's participation would be in the construction of knowledge, also emphasizing that the teacher's intervention would favor the individual's formation. This constructivist approach emphasized interaction and experience, aiming at individual development, the sociocultural context, the school, the curriculum, and the teacher, taking into account the student's daily life, establishing connections and meanings of their local reality.

Valente (2010, p.10-11) points out that all fields of knowledge are interested in their history, and by going back to the past we get to know the history of mathematics and mathematics education, observing the influence of both in the initial and continuing education process of teachers, attesting to the immense significance of noting how mathematical knowledge has been built, understanding that such heritages go through studies, discussions, and even reworking of the craft of other times, and that are still present today in the daily pedagogical practice.

According to Nogueira (2007, p.19), one of the reasons that led the state governments to worry about teacher training was the data from the assessments made by the System for the Evaluation of Basic Education (SEBE), which indicate that students do not master the skills and competencies of the years/series in which they are inserted.

However, the results of the performance in Mathematics have always shown an overall unsatisfactory performance. The area of geometry showed the lowest performance and the results of the survey indicated the need to develop and meet the educational and pedagogical needs that would meet the demand. The goal was to understand concepts that

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would establish a correlation with the students' daily practice and not teaching focused on the adoption of repetitive procedures. The intention was to promote a study based on problem solving, enabling students to establish relationships between the contents and their social practice, giving meaning to the educational proposals.

In an attempt to change the educational panorama, some states and municipalities started the process of implementing school flow acceleration programs, with the specific objective of promoting, according to medium and long term planning, the improvement of the several indicators of school performance. In this scenario, the Gestar I program (the object of our research) emerges with the purpose of contributing to the quality of student attendance, reinforcing the competence and autonomy of teachers in their pedagogical practice.

The origin of the practices that refer to the curriculum come from diverse intentionalities, determined by didactic, methodological, political, social, cultural, administrative, and economic behaviors. For Sacristán (1998) these behaviors result from assumptions, organizations of rationality, beliefs, different values that condition the theorization about the curriculum resulting in a set of senses and different meanings to it.

D'Ambrosio (2011) in his studies states that in continuing education programs for teachers, the curriculum is established as a set of strategies, in order to achieve the major goals of education, supported in solidary components, objectives, content and methods that demonstrate intense relationship among themselves.

As examples of curricula, there are teaching programs, curricular guides, parameters, references, guidelines, and many other terms for these documents, which are official records and sources of analysis that refer to the past and the dynamics that took place, being part of the historical construction. Present in the school subjects the selection of the curriculum, aims at the improvement of teaching and learning, in this sense it is possible to observe that the Mathematics destined to the basic school and teacher training changes with the time and its official expression is consolidated by documents that guide the teaching work (Valente, 2020).

## **Theoretical -Methodological Basis**

The theoretical and methodological references of the study are based on authors who deal with the history of school subjects (CherVEL, 1990), school culture (Julia, 2001) and the mathematics curriculum (Valente, 2009), using as research sources: A General Guide of the Gestar Program, eight booklets of Theory and Practice (TP), seven booklets of Learning Support Activities (LSA) and four booklets of Psychopedagogy.

Gestar I was an on-the-job continuing education program for teachers of the early years of elementary school, implemented in stages in the so-called Priority Assistance Zones (PAZ) covering the North, Northeast and Midwest regions, and developed with financial subsidies from the School Strengthening Fund (FUNDESCOLA), the National School

Development Fund (FNDE) and resources from the World Bank (WB), (Guia Geral, 2002, p.11).

In view of the results of the evaluations of the subjects of Portuguese Language and Mathematics carried out by the National System of Evaluation of Basic Education (SEBE), the schools belonging to the PAZ regions would be obliged to design and create the School Development Plan (PDE), which would address the strategic planning of each school unit specifying the main difficulties, the training needs, objectives, strategies, goals, action plans aimed at the quality of teaching and learning (Kochhann, 2007, p.65).

The teaching action and the trainings also start to meet the evaluation systems systematized by the International Program for Student Assessment (IPSA), Basic Education Development Index (IDEB), National Institute of Educational Studies and Research Anísio Teixeira (INEP), SEBE and Prova Brasil that direct their propositions, especially in the aspect of school failure experienced (Brazil, 1997).

For Julia (2001, p.34) systematically analyzing the practices in a given period is indeed an interesting work, as it makes it possible to understand and identify the changes and to visualize a new public that often triggers also the change of the contents taught.

Mathematics, a subject present in the curricula of all countries, seems to constitute a privileged subject related to the knowledge that expresses the school culture, becoming the target of the elaboration of several international proposals that aim at the construction of an ideal curriculum for the teaching of the subject universally (Valente, 2009, p.260).

The booklets of the Gestar I Program, provide didactic basis for continuing education of teachers in Mathematics, enabling the study of curricula and specifically the contents, showing the similarities, organization, methodologies, practices and adaptations made or idealized.

It is worth mentioning that the analyses undertaken in this article are exploratory and were limited considering the extensive didactic collection that constitutes the material that deals with the curriculum development of the Mathematics Gestar I Program. In this sense, we highlight the exploratory analysis of the booklets of Psycho-pedagogy, TP, LSA and the General Guide specific to the discipline, focusing on the search for the curricular conceptions/contents available in the material, operationalized in the contributions of Cultural History.

As Chartier (1990, p.19) states, the writing of history has its practice and operationalization of the social world taken by representations, which can be observed by actions that translate positions, interests, confrontations, but that describe society as they think it is or as they would like it to be.

## Results and Discussion

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The continuing education program Gestar I and the methodological resources used between the years 2001/2004 represent not only subjects and content taught, which are the means to achieve an end, providing historians the reconstitution of each stage, description of the didactic evolution, research the reasons for changes, revealing the procedures and purposes of the teaching exercise (Chervel, 1990, p.192).

The guidelines and organization of Gestar I, carried out in the cities of the PAZs, are laid out in the General Guide, which is the guiding document of the Program, containing the context of the program's development, the target audience to be served, strategies, integral actions, and the general objective of the program.

The pedagogical proposal, the General Guide presents the foundations and conceptions of quality education, school, definition of competencies, learning, evaluation, the role of the teacher, the importance of learning support, and continued education.

In the General Guide, the specific item that refers to the Mathematics curriculum proposed in the Gestar I for continued in-service training is highlighted. It presents the curricular matrix of theory and practice of Mathematics, with the following themes: Natural Number, Operations with Natural Numbers, Measures and Quantities, Geometry, Rational Number and Operations with Rational Numbers.

The curriculum matrix proposal of the Gestar I Program is based on the National Mathematics Curricular Parameters (NCP), since, in that period, the specific NCP for the subject of Mathematics comprised a state policy which established a national curricular reference, highlighting mainly aspects related to the construction of mathematical knowledge.

Another relevant aspect refers to the conception of the teacher's role as a mediator enabling the student to develop and learn through problem solving, promoting self-esteem and attitudes that could reinforce each student's abilities. In this context, the school is conceived as a formative space, presenting itself as the main component in the historical social construction (Brazil, 1997).

The NCP of Mathematics promoted a deep reflection on the teaching and learning of the subject, not only about the contents and its transforming potential, but mainly about the importance of this area of knowledge for the construction of citizenship (Pietropaolo, 1999, p. 187-189).

According to the author, the elaboration of the Mathematics NCP had a broad support, because they considered favorable the existence of a national curriculum, flexible, that would meet the diversity of the country. They saw the Parameters as a breakthrough for Mathematics Education, where the need for changes in the teacher education process was recognized (Pietropaolo, 1999).

The didactic material on Psychopedagogy, consisting of four booklets, covers the themes of professional identity, conceptions, concept formation, relationships, difficulties, possible social interactions, playfulness and the imaginary in the development of teaching and learning. These are fundamentals that provide methodological guidelines to teacher

trainers and trainees, where proposals are organized to be worked in the form of workshops that correlate with the contents of the TP and LSA Math booklets.

The studies by Hofstetter; Schneuwly & Valente (2017), point out that the institutionalization of knowledge contributes to thinking about pedagogical practice and the knowledge that results from these conceptions, as an object of teaching.

However, Bertini; Moraes & Valente (2017) corroborate the same assumptions that reveal the knowledge characterized *knowledge taught and knowing how to teach*. Thus, the knowledge to teach involves the *knowledge taught* in universities through the disciplines and the *knowing how to teach*, those related to the experience and practices of teaching.

The Psycho-pedagogy workshops relate the theoretical and practical development of the teacher mainly to what is defined in the professional knowledge to teach, especially when constant analysis of the relational process between teacher-student are proposed, of the difficulties of the teaching and learning process for students with disabilities, the insertion of playfulness as a practical tool, the need for social interactions, the interference of the biological and psychological processes directing the teacher to the specificities of his work, i.e., in the interpretation, understanding and applicability of skills and competencies necessary for the development process of teaching and learning.

The continuing education in Mathematics offered to teachers working in the early years of elementary school was carried out using teaching materials specifically developed for the Gestar I Program, which were inventoried during the searches in the personal collections of the Program participants (course attendees and trainers) and electronic repositories of the Ministry of Education (MEC).

The correlation between the TP and LSA booklets can be seen in the initial page devoted to the presentation and writing of the objectives, contents, and skills to be developed in each volume. The TP and LSA notebooks correlate and present the themes as shown in Table 1.

Table 1 - Gestar I Program: Contents of the Workbooks (TP) and (LSA)

Booklet	Themes of Workbook TP and LSA - Mathematics
TP 1	Planning Mathematics Teaching
TP2 – LSA1	Natural Number: concept and representation
TP3 – LSA2	Operations with Natural Numbers
TP4 – LSA3	Measures and Quantities
TP5 – LSA4	Geometry I
TP6 – LSA5	Rational Number: concept and representation
TP7 – LSA6	Geometry II: plane figures - geometric and metric characteristics
TP8 – LSA7	Operations with Rational Numbers

Source: General Guide Gestar I, p. 35-38.

The analysis of the TP and AAA notebooks of the subject of Mathematics were undertaken considering the process of teacher training with emphasis on professional knowledge, didactics and content contained in the teaching material, based on the curriculum that correlates to what refers to the mathematical content consolidated during the Gestar I Program.

There are many ways to carry out the research, and in this journey, it is necessary to set a discursive limit, which according to De Certeau (2020, p.33) is necessary to establish the moment when the limit becomes, at the same time, instrument and object of research.

The Textbooks (TP and AAA) enrich Cultural History, are sources that can help to build the paths and possibilities offered to teaching through learning, training and methodologies exposed through the various contents offered, appreciating its authors, expert, expertise, materiality, production, use, content, educational legislation, among others.

## **Analyzing Mathematics Content: Theory and Practice and Learning Support Activities**

### *Paper TP1 - Planning Mathematics Teaching*

Mathematical knowledge in TP1 is anchored in Science, aiming relations with other fields of knowledge always resorting to the use of language, skills, abilities, selection of content and methodologies specific to the discipline.

TP1 explains the skills and content in learning mathematics as inseparable aspects, and assigns the teacher trainees the practice of systematic observation, making interpretations, proposing hypotheses, developing problem-solving strategies, presenting results, and also relating these skills to mathematics content (TP1, 2007, p.29-34).

They conceive the subject of mathematics as a science constructed throughout humanity, based on the problems that reality imposes on them, considering it as an instrument that relates to and assists in the understanding of other fields of knowledge. Mathematical language is universally understood as a competence to be developed, in order to perfect and formalize it, whether through oral language, representations, and argumentative presentations (TP1, 2007, p.9-23).

There is identification of mathematical knowledge, as a way to understand and transform the world around them, perceiving the intellectuality of mathematics providing the stimulus, interest and investigative action for problem solving, relating the feeling of being safe, capable and with self-confidence for the construction of mathematical knowledge (TP1, 2007, p.128).

In TP1, the analyses show that the approach that refers to the specific work of building mathematical knowledge is based on the following question *What is mathematics for?* It is then proposed to study it as a science developed by mankind, based on problems that arise from the needs raised by each one, which, in turn, are represented by problems arising from society itself. This question would be the opportunity to treat the resolution of a problem with the students, starting with the study of the construction of some numbering systems based on a brief historical review.

The analysis of TP1 places more emphasis on the knowledge to teach, since, according to Valente (2017, p.214), teacher training at the primary and secondary levels is related to the fields contained in the knowledge of their training and belonging to the educational sciences, originating from the teaching work itself.

The didactic proposal of the Textbooks (TP) and (LSA) are based on the constructivist theory, and can be evidenced mainly in the proposals of group activities, mediated by the teacher and instrumented by the use of games and representations.

#### *Booklet TP2/LSA1 - Natural Number: concept and representation*

The TP2/LSA1 booklet has as general theme the Natural Numbers, for its development it is assumed to consider initially the previous knowledge about the concept of number and gives direction as for the diagnosis, emphasizing that in the elaboration the teacher considers the abilities to be developed by the students, proposing didactic situations, from the diagnosis of hypothesis of the children.

It is also suggested argumentation and reflection that involves reciting the sequence of names of numbers, building a collection of objects, enumerating with competence, set of objects, quantifying, identifying the successor of a number, reading and counting numbers (TP2, 2007, p.7-24).

It appears as theoretical and practical objectives to lead students to develop groupings and exchanges on several bases: finding successor and predecessor numbers; comparing quantities and sorting and decomposing natural numbers.

For Muniz (2010), the child at birth would already be a mathematical being, and growing up, liking or not liking math points out how much we knew how to work it as a being, because the mastery of mathematics goes beyond numerical recitation, and awakening these skills is of fundamental importance in children's mathematical literacy.

The conceptual approach proposed in Booklet TP2 shows that the teaching of number systems is positional, that is, each quantity is represented in a single form, according to a certain combination of symbols, noting that each symbol has a distinct meaning, according to its position. Such representations are inherent to human nature and to the child, and when stimulated, they mobilize specific skills that favor the development of numerical processing and mathematical thinking (Muniz, 2010).



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The activities proposed in TP2 are mainly based on the problem-solving methodology, indicating didactic situations associated with the overall learning of mathematics regarding the concept of numbers, such as the use of games and collections help develop the ability to compare elements, or using numbers to compare and enumerate. Over-counting would contribute to the gradual development of the ability to perform mental calculations and compare quantities by matching term to term (pairing) or "group to group" and estimation.

It approaches the appropriation of the characteristics of the Decimal Numbering System (SND) and the personal operative procedures to apply operative techniques that include grouping, representation, and exchange actions, exploring the inverse movement (exchange/unexchange and later add/subtract).

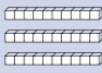
Registro, com algarismos

C	D	U
0	2	9

Após o registro, sugira às crianças que coloquem as peças enfileiradas numa linha, para que possam fazer a contagem de cubinho em cubinho, perceber que são "vinte e nove" e comparar com a escrita obtida.



A seguir, sugira que acrescentem um novo cubinho aos demais. Novamente, eles serão incentivados a usar a menor quantidade possível de peças. Em seguida, deverão registrar com algarismos, o resultado obtido.

PLACA	BARRA	CUBINHO
		

Registro, com algarismos:

C	D	U
0	3	0

Figure 1 - Natural Numbers

Source: Booklet TP2, p. 56.

The activity provides the student with the perception of the positional value and the nomenclature of the orders: unit, ten and hundred, which begin to have meaning for the child, and later deepen the concepts of predecessor and successor. The tool systematization of the operating procedures and their techniques are activated, demonstrating the various ways of carrying out the practice of teaching the knowledge that society institutionally assigns to the school, characterizing the knowledge to teach, as a historical product of the teaching profession (Valente, 2017, p.214).

For Perrenoud (2000, p.27) working from the representations of the students, grants them the real and regular use of their own rights in class, in being interested, exposing and understanding their own roots and to the teacher the task of putting himself in the place of the learners.

The teacher when observing the routine of the students gives beginning to the familiarization to the numerical aspects, when it proposes diverse games and through them, it looks for to identify how, when, which meanings and ideas the students have when using numbers, and sometimes, answering correctly or in a wrong way or recurring the recitation of

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the numerical sequence, it is observed like this, that several answers are constructed outside the school and limited to the experience of each one (TP2, 2007, p.9-12).

In this diversity, the teacher has the possibility to collect information identifying the know-how of mathematical ideas, their reflections, intuitions that are their own (TP2, 2007, p. 12-13). In this sense, the construction of knowledge is related to the appreciation of teaching, therefore, the subject of mathematics does not occur as a mere expression of interest or way of thinking of teachers who teach mathematics, but it should be understood in a context that has a broad social recognition (Búrigo, 2006, p. 37).

### *Booklet TP3/LSA2 - Natural Numbers Operations*


When analyzing the TP3/LSA2 booklets whose themes deal with Natural Number Operations, the selected contents cover addition, subtraction, multiplication and division of natural numbers in an integrated treatment perspective, in order to move towards the development of calculation and mathematical operations through information processing, relating the collection and organization of data.

The conceptual part seeks to focus on the numbers that represent the results of a measurement, or the result of comparisons between quantities, or the result of a division, relating their use in the social context, building this concept and giving meaning to the other possibilities of representations.

The suggestions for activities related to the meanings of addition and subtraction are focused on problem solving using the additive and subtractive scripts of the natural numbers, observing regularities and using the properties of addition.

The additive repertoire itself (addition tables) guides the propositions of the development of tables, identifying the individual as memorizer or reconstructor. These are experiences that enable the selection and search for strategies that lead to the construction and understanding of the concept and ideas of these operations. The activities deal with aspects of the multiplicative principle, and in division, the work also considers divisions not always in unequal parts.

In the activity, it is suggested that the teacher use a box composed of pebbles or grid paper and ask students to take and put a certain amount make notes in the table, initially exploring the additive and subtractive ideas of problem situations using their own strategies (TP3, 2007, p.24).

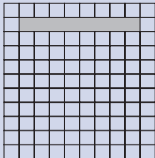
**INDO À SALA DE AULA** 

**Pintando tiras**

**1ª situação:**  
 Dê a cada aluno uma folha quadriculada com uma tira pintada de cinza.

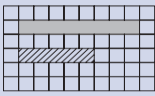
Solicite a eles que pintem outras tiras do mesmo tamanho dessa, porém com duas partes pintadas de cores diferentes.

As tiras pintadas devem ser todas diferentes entre si e as cores utilizadas também. Peça aos alunos que representem cada tira pintada com uma escrita aditiva ao lado dela.



**2ª situação:**  
 Dê a cada aluno uma folha como o modelo ao lado.

Proponha às crianças o seguinte problema:  
 "Se da tira cinza você tirar um pedaço do tamanho da tira listada, que tamanho da tira você obterá? Represente isso com uma sentença matemática".



**3ª situação:**  
 Qual é a barra maior?  
 Quanto ela é maior?  
 Como você representa essa diferença com uma escrita matemática?

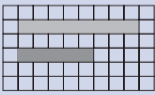


Figure 2 - Operations with Natural Numbers  
 Source: Booklet TP3, p. 24.

To give meaning to the symbols, the teacher introduces the use of the signs (+, - and =) explaining and noting the situations created with the removal and gain. The use of symbols is initiated and associated with the specifics of the Mathematics discipline, but this use should be geared considering the assimilation and association time of each student.

This proposal would help in the improvement as the basic and fundamental aspects of the operative techniques of addition and subtraction and usual algorithms are used. In addition, new situations are proposed by increasing the order of magnitude (size) of the numbers involved, where the children's conditions of thought evolve, moving from the operational concrete period to the pre formal one (TP3, 2007 p. 24-25).

The propositions of the contents contained in the TP3/LSA2 booklets follow the guidelines of the Mathematics PCN, considering that the proposals in this period were conceived as "modern" due to the new approaches in relation to the contents, because they dimensioned the procedures and attitudes, establishing also, the relation between the blocks of contents, the everyday life, Mathematics and the transversal themes (Matos, 2012, p.16).

#### *TP4/LSA3 Booklet - Measures and Quantities*

The theme Measures and Magnitudes are worked in the booklets TP4/LSA3, the proposed content turns to the concept of measure, it is explained what is to measure by the use of standardized and non-standardized units of measure.

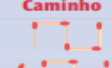

Length, Area, Capacity, Mass, Time and Temperature are the magnitudes selected for the conceptual and practical study. In the activities, the strategy adopted is to include the Decimal Numbering System (DND) content, taking advantage of the measurement process and all the characteristics for the record.

The activity emphasizes the SND units, most used in everyday life, such as length and area. It identifies what would be needed for the student to understand what it is to measure, using length, proposing, for example, to measure one's own step. Clarifies that this way of

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measuring would be a non-standard unit, because each person's step is different, has a particular length, not known and not adopted by everyone. Another suggestion is that the student makes the meter, an opportunity to handle, organize and not waste and also understand the relationship held by the meter, with the centimeter and decimeter, integrating the role of the comma in the number that represents a length measure in the Decimal Metric System (TP4, 2007, p.40-48).

2. Os alunos também poderão construir caminhos com diferentes quantidades de palitos e representar suas "medidas" numa tabela como a seguinte:

Aluno	Medida (em )	Caminho	Aberto ou fechado?
João	5		Aberto
Maria	7		Aberto
Davi	5		Fechado

Ao comparar os caminhos obtidos, as crianças poderão concluir que eles têm formas e comprimentos diferentes. Entretanto, se lhes for solicitado que, com 12 palitos, cada uma faça um caminho fechado, elas poderão perceber que, apesar de todos apresentarem o mesmo comprimento, esses palitos podem aparecer de formas diferentes.



Figure 3 - Measures and magnitudes

Source: Booklet TP4, p.41.

The contents of TP4/LSA3 bring the guidelines present in the NCP of Mathematics (1997, p.58). The methodological aspects are developed clarifying the need to choose and compare certain units of measurement, highlighting their suitability according to the problem situation. The use of unconventional instruments stands out as a proposed alternative, and demonstrates the intention to value personal strategies and also those that are fruits of the historical evolution of mathematical knowledge.

In this sense, the exposed curriculum places as relevant the articulation of content with its use and social cultural function, contributing to the intellectual formation of the student, highlighting their potentialities and affinities through the identification and construction of skills and interdisciplinary connections, contextualized, accessible and consistent with the content and the age group of students (Vece; Cury; Santos, 2017).

#### *Booklet TP5/LSA4 - Geometry I*

The teaching of Geometry has its proposal developed in two parts. The first one is in the TP5/LSA4 booklets, called Geometry I. The proposal of teaching the Geometry content is based on the familiarization with objects from the physical world, in a geometric perspective.

The passage from space to the plane and the identification of symmetry are placed as important strategies for the development of this content and of specific skills on the aspects

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that deal with the spaces in which one lives, emphasizing the use of handling, observation, and classification practices, either by establishing own or pre-established criteria.

In the activities, the classification of solids and identification of polyhedral elements are suggested, emphasizing the perceptions of the figures as a whole and, subsequently, the analysis of the characteristics and properties of each one is considered, with the intention of effecting learning with the mastery of the classification and identification skills of the elements of plane figures, not plane, being geometric solids polyhedral or round bodies.

The authors suggest that it is through the observation of objects that students begin to perceive the characteristics of figures and the differences between plane and non-planar figures. The teacher in providing this type of activity provides the student with an experience in other skills that approach geometric practices and concepts, (Hofer, 1981, p.10). The construction of the definition of prisms and pyramids occurs conceptually and also by suggesting activities involving observation (TP5, 2007, p.37), highlighted in Figure 4.

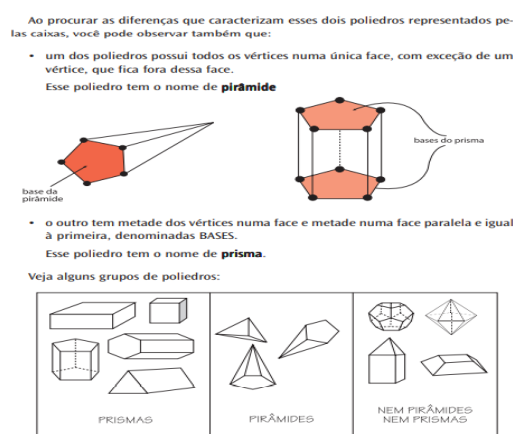


Figure 4 - Geometry I

Source: Booklet TP5, p.37.

It is possible to observe that the authors seek the recognition and differentiation between geometric figures by the perception of their characteristics, in this case highlighted through the representation of polyhedral that have all vertices in a single face, except for one vertex that is outside this face, being called as pyramid. The other polyhedron has half of the vertices in one face and half in a face parallel and equal to the first, called bases, this polyhedron is called a prism.

The research in search of guidelines on what and how to teach geometry are numerous, and find efforts in teacher training, aiming to allow them to do a quality job in relation to this subject (Pavanello, 2009).

The selected contents point out that the paths of Geometry teaching effectively break with the maxim that it is necessary to end the study in plane Geometry to then investigate Geometry in space, whose direction starts from the simple to the complex, in a scientifically logical-formal deduction (Leme da Silva; Silva, 2019).

The TP6/LSA5 notebooks have as their main subject of Mathematics, the rational numbers conceptual and representational development. The conceptual part is related to the expression of the measure of a quantity, and also as a way to express the result of a division between two natural numbers (with the 2nd one different from zero) or as a ratio; it also has the task of verifying the rational number from some meanings: quotient, part-all, ratio as the result of divisions and comparisons and in the way to represent each one of these parts.

The deepening of the theme addresses the contents equivalence of fractions, comparison and ordering of rational numbers, representation and writing in fractional and decimal form. It is observed the exploration and explanation of the meaning of the decimal representation of a rational number, comparison and ordering of rational numbers in their decimal representation.

In the materials, the contents and activities are presented through problem situations that lead to the perception that only natural numbers are not enough to represent and solve countless situations in everyday life. The aim is then to recognize rational numbers in the daily context, either by the quotient of the part/all relationship or a ratio, by the different registers in the forms  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$  and comparison and ordering of fractional numbers.

TP6 directs the study to the formation of the rational number concept and advises that the initial activities start from the students' reality, so the rational numbers arise as a consequence of measurement situations, that is, it is necessary to go beyond the concepts of natural numbers to solve everyday problems. Thus, the concept of fraction is given through the part-all relationship between magnitudes that are counted (TP6, 2007, p.9-13).

#### 1º exemplo

As fachadas dos prédios ao lado têm todas as janelas iguais.

É muito fácil verificar que para cada janela da fachada do prédio A não existe uma única janela na fachada de B, simplesmente porque os dois prédios não têm o mesmo número de janelas na fachada.

Entretanto, se agruparmos as janelas de A de 2 em 2 e as de B de 3 em 3, obteremos a mesma quantidade de grupos de janelas nos dois edifícios. Isso significa que **para cada 2 janelas da fachada de A, existem 3 janelas na fachada de B.**

O símbolo  $\frac{2}{3}$  é adequado para descrever essa situação pois podemos ver que, se no prédio B dividirmos as janelas igualmente em 3 grupos e tomarmos 2 desses grupos, eles terão o mesmo número de janelas do prédio A. Ou seja, as janelas de A correspondem a  $\frac{2}{3}$  das janelas de B.

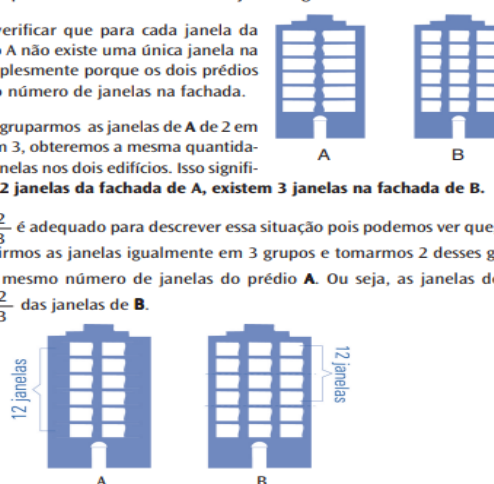


Figure 5 - Rational Numbers: concept and representation

Source: Booklet TP6, p.34.

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As for fractions, Bertoni (2008) emphasizes that the teaching of fractions was far from its relation with number, so that the operational rules appeared later and assimilation occurred by memorization or memorization without any articulation between the concepts. Only gradually were perceptions about the exploration and learning by the meaning of the divided parts emerging.

According to the author, learning about fractions and the concept of fractional number is not built only by dividing geometric figures into equal parts and memorizing the operational rules. According to the author, it is necessary to find and develop ways to lead the student to identify these quantities in their everyday life and to appropriate the corresponding fractional number idea, using them in a meaningful way (Bertoni, 2009, p.2).

*Booklet TP7/LSA6 - Geometry II: plane figures - geometric and metric characteristics*

The Geometry theme is developed again in the TP7/LSA6 notebooks, and is based on the study of solids and plane figures, exploring their surfaces. The relation includes the contents of angles, conceptualization and characterization of polygons, parallelism and perpendicularism, construction of plane figures, composition and decomposition of figures, circles, classification of triangles and quadrilaterals.

These contents are resumed with emphasis on the teaching and learning of plane figures that can be identified in everyday objects, reflecting on the propositions of folding activities, composition and decomposition of figures, inscribing and circumscribing a figure in another, selected concepts considered fundamental to learning geometric concepts.

It proposes activities directed to the exploration of solid surfaces and it is expected that the students are already familiar with the plane figures in order to recognize, identify, compare and differentiate them (TP7, 2007, p.10-19).



Figure 6 - Geometry II  
Source: Booklet TP7, p.12.

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Some ways to explore the solid's surface in the classroom are specified, starting with possible situations to identify the plane figures that are part of the analyzed surface, perform disassembly and planification operations, compose and construct the solids, and some actions are detailed in the form of reminders.

The analysis of the TP and LSA notebooks of Geometry are sources of research in the investigation of the history of the school discipline and of the curriculum, denoting its importance and possibilities to verify how the authors appropriated the legislation or recommendations (Leme da Silva, 2005).

Sacristán (1998) considers that there is a huge gap between the curriculum set out in official documents and curriculum effectively developed in the classroom, because each teacher has its practice and its individual peculiarities that characterize their actions and methodologies, mixed with their experience coming from their professional context, so is the curriculum is shaped day by day by their practical development.

For Leme da Silva (2005) the geometry curriculum proposition in this period is concerned with the simultaneous development of several cognitive skills, such as memorization, synthesis, analysis, generalization, induction, establishment of hypotheses and conjectures, validation of strategies and results. Above all, the contextualization demonstrates great and evident concern with the insertion of mathematics in the students' daily lives.

#### *Booklet TP8/LSA7 - Operations with Rational Numbers*

The booklets TP8/LSA7 with the central theme of Operations with Rational Numbers involving the contents of addition, subtraction, multiplication and division with rational numbers, under decimal and fractional representation, are still selected to be worked out the relations between the decimal, fractional and percentage forms of a rational number. The intention is to seek the use of personal or conventional strategies to solve simple calculations of percentage, identifying their use in the daily context.

The contents are systematized with the purpose of mastering the abilities of the ideas related to rational numbers linked to the use of games and concrete material, and it leads to the study of multiplication and division operations of rational numbers, under decimal representation by natural numbers.




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**2ª Situação**

Vamos passar, agora para a segunda ilustração.

Veja o que indica a balança no 1º caso e descubra quanto ela deve indicar no 2º caso:



Percorrendo a classe, a professora foi observando alguns alunos com dificuldades, orientando-os com perguntas que pudessem levá-los a descobrir uma operação a ser realizada para encontrar o resultado procurado.

Terminada a atividade, a professora solicitou que alguns alunos registrassem no quadro de giz, o que haviam feito. Apareceram as respostas:

$$0,500 + 0,500 + 0,500 + 0,500 + 0,500 + 0,500 + 0,500 + 0,500 + 0,500 + 0,500 = 5,000$$

e

$$10 \times 0,500 = 5,000$$

Retomando as observações já feitas na 1ª questão, os alunos observaram novamente que "o resultado era escrito com os mesmos algarismos, mas a vírgula havia mudado de lugar".

Figure 7 - Operations with Rational Numbers

Source: Booklet TP8, p.25.

For Muniz (2010) the mathematical learning present in the school and training curricula is not limited or ends in games, since many mathematical concepts and procedures can be mobilized by the players in an unconscious way, considering the essential fact of diversity in the processes of producing and learning mathematics since the early years of life.

## Final Considerations

The on-the-job continuing education of Gestar I (2001/2004) characterizes the teacher in the development of his or her practice and knowledge. The analyses of the program and the didactic material allow us to reflect on the teaching methods used by the teachers, taking into consideration the social, political, economic, and cultural context.

Even though it is a recent period, the research allows us to reveal the daily life of other times, in such a way that it directs and transposes giving physical reality to a new production, extending the existing relations mainly between the disciplinary fields of Mathematics and Pedagogy.

In analyzing the sources, we can see the presence of the knowledge needed by the teacher of the Early Years to teach Mathematics. The knowledge to teach is evident in the TP and LSA Notebooks when they highlight the subject contents that should be developed and explored by the teacher in the classroom. The knowledge to teach becomes more accentuated when it emphasizes teaching and the experiences coming from the social sciences, which include the knowledge of Psychology and Didactics, in the improvement and enhancement of professional skills.

This historical and cultural apparatus integrates the process of understanding the way and manners experienced in the social and teaching realities, where other possibilities of researching and writing about the proposals of the professional trainings that were practiced

and gave the opportunity to reflect and exchange experiences are envisioned, presenting a work that helps to weave the knowledge.

However, the school mathematics present in the Gestar I Program, emphasizes the institutionalization and professionalization of teaching, putting in evidence the mathematics to and to teach and the objectification of knowledge, legitimized over time, standardized and disseminated to teachers during continuing education, inherent in the pedagogical practice, as a proper instrument of the teaching action, where new knowledge is formed that results in transformations that enable the construction of new plots about historiography.

The analysis of the didactic material of the Gestar I Program proposes reflections about the development of the subject of Mathematics, the contents selected to be worked on, the practices, organizations and methodological foundations that contribute to reconstitute what refers to remarkable periods that characterize the history of Mathematics Education.

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